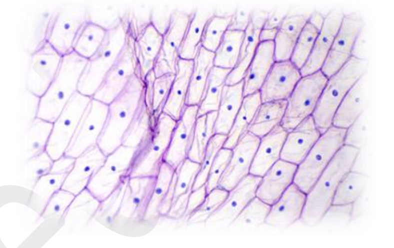
Unit 1 – Concept 1
{ The cell as a system }



- The first **system** we will consider is **the cell.**

Cells — They are the basic units, or building blocks, of life on Earth.



- Cells are found only in living organisms.
- Cells are very small. We need a microscope to see them.

Cells function:

- Cells carry out all the functions that organisms need to live, such as:
  1. Growing
  2. Repairing themselves
  3. Reproducing
  4. Responding to the environment

- النظام الأول الذي سننظر فيه هو **الخلية**.
  - توجد الخلايا في أجسام الكائنات الحية فقط

الخلايا هي وحدات بناء الكائنات الحية. الخلايا صغيرة للغاية، حيث نحتاج إلى ميكروسكوب لرؤيتها.

وظيفة الخلايا:

تؤدي جميع الوظائف التي تحتاج إليها الكائنات الحية لتعيش وتشمل تلك الوظائف:

1. النمو
2. تعويض الخلايا التالفة
3. التكاثر
4. الاستجابة للبيئة المحيطة.

Building Blocks of Living Organisms

What is the common thing between plants and animals?



- Both plants and animals are living organisms made of **cells**.
- The cells of plants and animals are different in **shape** and **size**.

Cells as Building Blocks

- Just as the **toy building blocks** can be used to create castles, **cells** are the building blocks that form many different living things.
- A cell is the **smallest basic unit** of life, and it's responsible for all of life's processes.
- Cells are the structural, functional, and biological units of all living beings.

ما هو الشيء المشترك بين النباتات والحيوانات؟

- كلاهما كائن حي يتكون من عدد من الخلايا.
- تختلف خلايا النبات عن الحيوان في الشكل والحجم.

الخلية كوحدة البناء

- كما تستخدم المكعبات اللعبة لإنشاء القلاع، فإن الخلايا عبارة عن وحدات تشكل العديد من الكائنات الحية المختلفة.
- الخلية هي أصغر وحدة أساسية للحياة، وهي مسئولة عن جميع العمليات الحيوية.
- الخلايا هي وحدات التركيب، والوظيفة، والحياة لجميع الكائنات الحية.

Size of the Cell

Most cells are **very small**

Some cells are **very large**

Examples

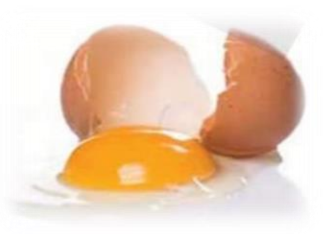
- **Common plant or animal cells**
  - They are between 0.005 and 0.1 mm long.
- **Bacteria**
  - They are usually smaller than this.



You will need a microscope to see them.

- **An unfertilized bird egg**
  - It contains only one egg cell.

بيضة الطائر غير المخصبة تحتوي بداخلها على خلية واحدة فقط.



NOTE:

- The unaided human eye can see objects that are about 0.1 millimeters (mm) long.

  العين البشرية المجردة يمكنها رؤية الأشياء التي يبلغ طولها ما يقرب من 0.1 ملليمتر.

Organism Growth and Cells

- Living organisms grow and reproduce by increasing the **number** of cells.
- All new cells come from existing cells.

نمو الكائن الحي والخلايا: تنمو الكائنات الحية وتتكاثر، من خلال زيادة عدد خلاياها.

Properties (Characteristics) of Cells:

- Most cells are so small and cannot be seen without a microscope.

Living organisms are classified according to the number of cells into

Unicellular organisms

They are organisms made up of only one cell.
Ex: Bacteria

Multicellular organisms

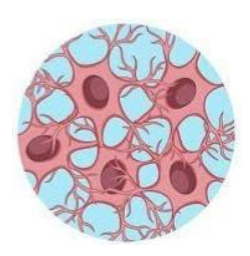


They are organisms that have more than one cell.
Ex: Complex organisms, such as humans, animals and plants.

- Our bodies contain many different kinds of cells with different functions.



Blood Cells



Brain Cells



Muscle Cells

خصائص (سمات) الخلايا:

- الخلايا صغيرة للغاية، حيث تحتاج إلى ميكروسكوب لرؤيتها.
- يمكن تقسيم الكائنات الحية من خلال عدد الخلايا إلى نوعين:
  - **كائنات أحادية الخلية** هي الكائنات التي تحتوي على خلية واحدة **مثل** البكتريا.
  - **كائنات متعددة الخلايا** هي الكائنات التي تحتوي على أكثر من خلية واحدة **مثل** الإنسان أو الحيوان أو النبات .
- تحتوي أجسامنا على العديد من الخلايا المختلفة التي تقوم بوظائف مختلفة.

NOTES:

- All cells consist of a cell membrane.
- Not all cells have a nucleus, such as red blood cells.

- جميع الخلايا تتكون من غشاء الخلية.
- ليست كل الخلايا لديها نواة مثل خلايا الدم الحمراء.

Cell Needs

- Cells are microscopic building blocks of all living organisms.
- The cell is a **complex** structure that carries out all its own life activities.



احتياجات الخلية:

- الخلية هي وحدات بناء مجهرية لجميع الكائنات الحية.
- الخلية عبارة عن تركيب **معقد** تقوم بكل أنشطة حياتها الخاصة.

Give a reason for:

- Cells are important.
  - Because cells carry out all the functions that organisms need to live, such as:
    1. Growing
    2. Repairing themselves
    3. Reproducing
    4. Responding to the environment

Basic Needs of a Cell

- The basic needs of a cell are similar to the needs of all organisms, such as:

1 Oxygen gas and food to get energy **2** Water

- Cells have a way of **taking in** the needed materials and using them to get energy, grow, and live.
- Cells have a way of **releasing** waste products.

الاحتياجات الأساسية الخلية:

- تتشابه الاحتياجات الأساسية للخلية في جميع الكائنات الحية وهي:
  1. غاز الأكسجين والغذاء للحصول على الطاقة. **2.** الماء
- الخلايا لها وسيلة لأخذ العناصر اللازمة واستخدامها للحصول على الطاقة والنمو والبقاء.
- الخلايا لها وسيلة للتخلص من الفضلات

Cell (Plasma) Membrane

➡ It controls (regulates) which substances can enter or leave the cell.

Outside the cell
Cell Membrane
Inside the cell

Give reasons for:

- The cell membrane allows water to enter the cell.
    - Because water is a basic need for the cell to live.

- The cell membrane allows water to leave the cell.
    - To maintain the proper water balance on both sides of the cell membrane.

What happens if:



- Too much water enters the cell.
    - The cell will swell until it bursts.

الغشاء الخلوي:

❖ يتحكم الغشاء الخلوي في المواد التي تدخل أو تخرج من الخلية.
❖ يسمح الغشاء الخلوي للماء بالمرور داخل الخلية حيث إن الماء ضروري للحياة.
❖ يسمح للماء بالخروج من الخلية وهكذا تكون الخلايا قادرة على الحفاظ على توازن الماء على جانبي الغشاء الخلوي.
❖ إذا دخل الكثير من الماء إلى الخلية، فستنتفخ الخلية حتى تنفجر.



Brief History of the Cell

The scientist: Robert Hooke:

- He used the newly invented microscope to observe some too small things to be seen by the unaided eye.
- He looked at samples and described little sections in them.
- He was the first person to use the word "**cell**".





العالم روبرت هوك

- استخدم الميكروسكوب الذي تم اختراعه حديثا لمراقبة الأشياء الصغيرة جدًّا التي لا يمكن رؤيتها بالعين المجردة.
- فحص هوك بعض العينات ووصف الأجزاء الصغيرة فيها.
- كان هوك أول شخص يستخدم كلمة خلية لوصف هذه الصور الدقيقة.

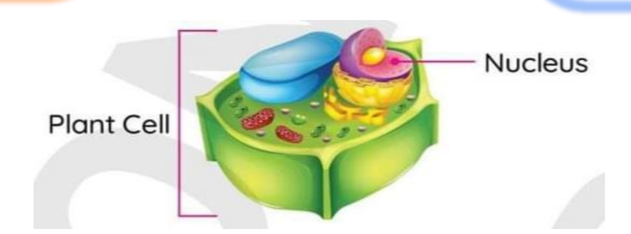
Improved microscopes have allowed scientists to make **new discoveries**, **for example**:





The nucleus of a cell was discovered through observation of numerous plant cells.

Later, scientists determined that cells are the basic unit of structure in living things.



سمحت أجهزة الميكروسكوب المطورة للعلماء باكتشافات جديدة، على سبيل المثال:

- تم اكتشاف نواة الخلية من خلال مراقبة العديد من الخلايا النباتية.
- وفي وقت لاحق، توصل العلماء إلى أن الخلية الوحدة الأساسية للبناء في الكائنات الحية.

Give reasons for:

- Scientists have developed microscopes.
  - To be able to look at small things in more details.
- Scientists used information learned from one another's research.
  - To understand cells better today.

- قام العلماء بتطوير أجهزة الميكروسكوب لرؤية تفاصيل الأشياء متناهية الصغر.
- ساعد ذلك على أن يصبح في إمكان العلماء اليوم استخدام المعلومات المستنتجة من أبحاثهم لفهم الخلايا بشكل أفضل.

What happens if:

- The microscope wasn't invented.
  - Scientists would not be able to discover the cell and its structure.

Hands-on Investigation: Using a Microscope to View Cells

Experiment

- In this activity, you will also make observations and draw what you see when you look at the skin of an onion under a microscope.

Tools:



Slice of skin of an onion
شريحة من جلد البصل



Slide of skin of an animal
شريحة من جلد الحيوان



Distilled water
مياه مقطرة



Compound microscope
المجهر المركب



Eyedropper
قطّارة



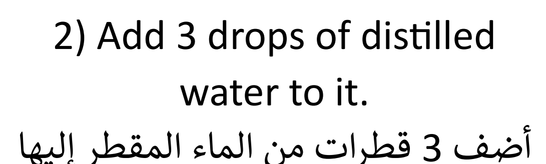
Glass slide
شريحة زجاجية



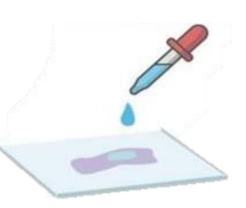
Coverslip
غطاء شريحة

Steps:

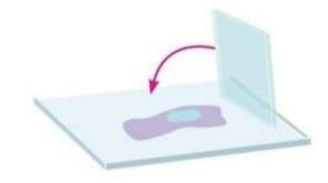
1) Place the thin membrane of an onion in the center of a glass slide.
ضع الغشاء الرقيق للبصلة في وسط شريحة زجاجية



2) Add 3 drops of distilled water to it.
أضف 3 قطرات من الماء المقطر إليها



3) Carefully place the coverslip over it.
ضع بحذر غطاء الشريحة فوقه



4) Examine the sample under the compound microscope.
افحص العينة تحت المجهر المركب

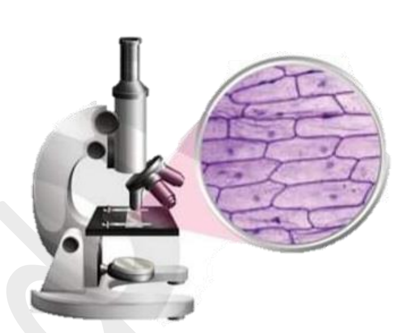


5) Repeat the previous steps on a slide of skin of an animal.

كرر الخطوات السابقة على شريحة من جلد الحيوان.

Observations:

- The samples of an onion and an animal consist of small units known as cells.
- The shape of the cells is different for the two samples.
- Each cell contains many components.



- تتكون عينات البصل والحيوان من وحدات صغيرة تعرف بالخلايا.
- شكل الخلايا مختلف للعينتين.
- كل خلية تحتوي على العديد من المكونات.

Conclusion:

- Cells are the smallest building units that form different living organisms.

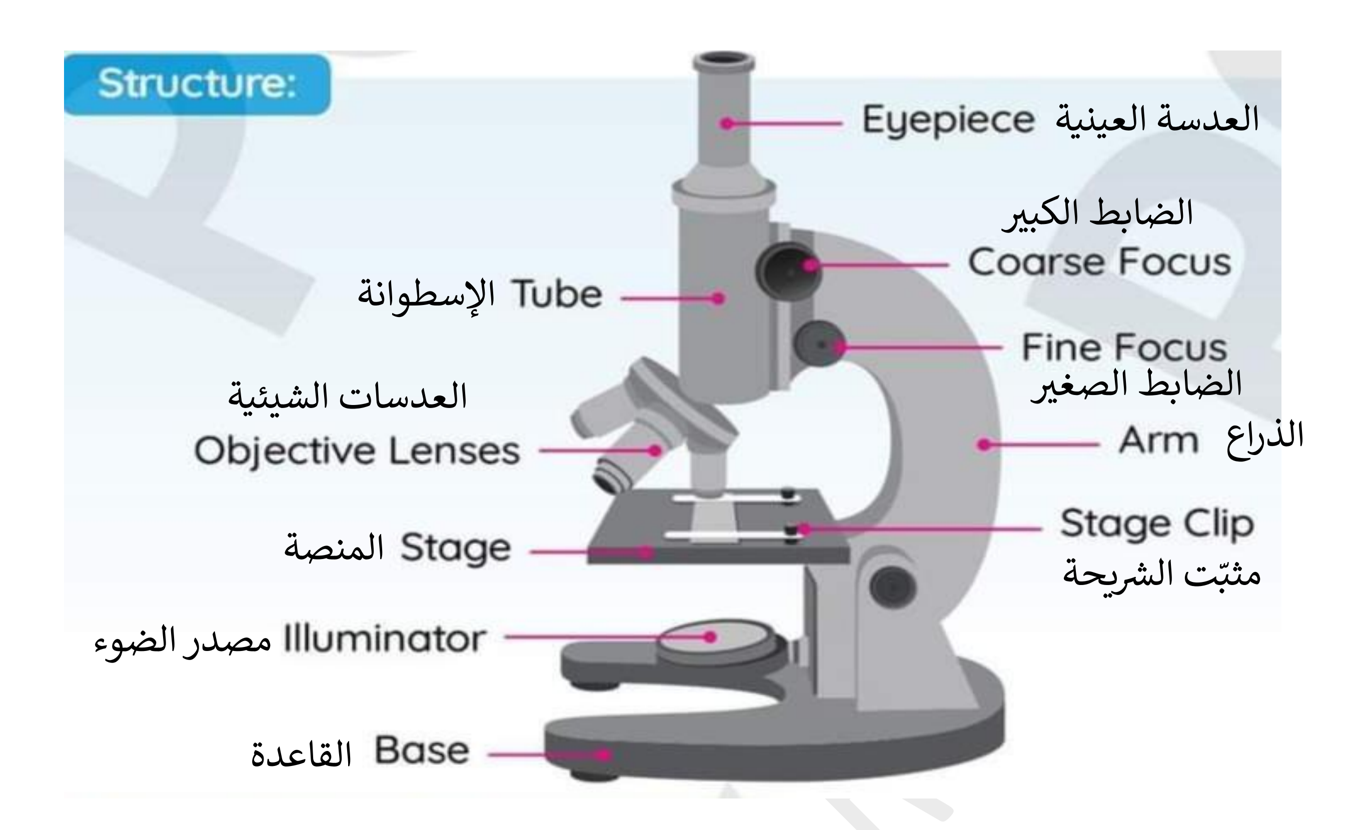
  الخلايا هي أصغر الوحدات البنائية التي تكوّن كائنات حية مختلفة.

Compound Microscope

Importance

- It magnifies cells that can't be seen by the unaided eye.

  يكبّر الخلايا التي لا يمكن رؤيتها بالعين المجردة.



Steps of using the microscope:



1) Place the microscope slide on the **stage** and secure it with the **stage clips**.
2) Pick up the lowest-power **objective lens**.
3) Look at the slide through the **eyepiece** while adjusting the focusing knobs to get more clear view of the specimen.
4) Clean up the slide and store the microscope safely when you are finished.

خطوات استخدام المجهر (الميكروسكوب) :

1. ضع شريحة الميكروسكوب على **المنصة** وثبّتها **بمثبت الشريحة**.
2. التقط **العدسة الشيئية** ذات الطاقة الأقل.
3. انظر إلى الشريحة من خلال **العدسة العينية** أثناء ضبط مقابض التركيز للحصول على رؤية أكثر وضوحا للعينة.
4. قم بتنظيف الشريحة وخزّن الميكروسكوب بشكل آمن عندما تنتهي.

NOTE:

- You can change the magnifying power by changing the objective lens. (Focal length)

يمكن تغيير قوة التكبير عن طريق تغيير العدسة الشيئية (البعد البؤري)



The Parts of a Cell

Living organisms are classified according to the number of cells into:

تصنّف الكائنات الحية حسب عدد الخلايا إلى:

Unicellular organisms

- They are organisms made up of only one cell.

Ex: **Bacteria**

- The number of cells in living organisms varies.

الكائنات الحية وحيدة الخلية :

- هي كائنات حية تتكون من خلية واحدة فقط.

مثل: **البكتيريا**

- يختلف عدد الخلايا في الكائنات الحية.

Multicellular organisms

- They are organisms that have more than one cell.

Ex: **Complex organisms** such as humans, animals, and plants.

الكائنات عديدة الخلايا:

- هي كائنات حية تحتوي على أكثر من خلية واحدة.

مثل: **الكائنات المعقدة** مثل الإنسان والحيوانات والنباتات.



The number of cells in living organisms varies, as follow:

Human

A human has about 40 trillion cells.

Animal

An animal has a variety of cell types, including:

- Muscle cells
- Bone cells
- Blood cells

Plant

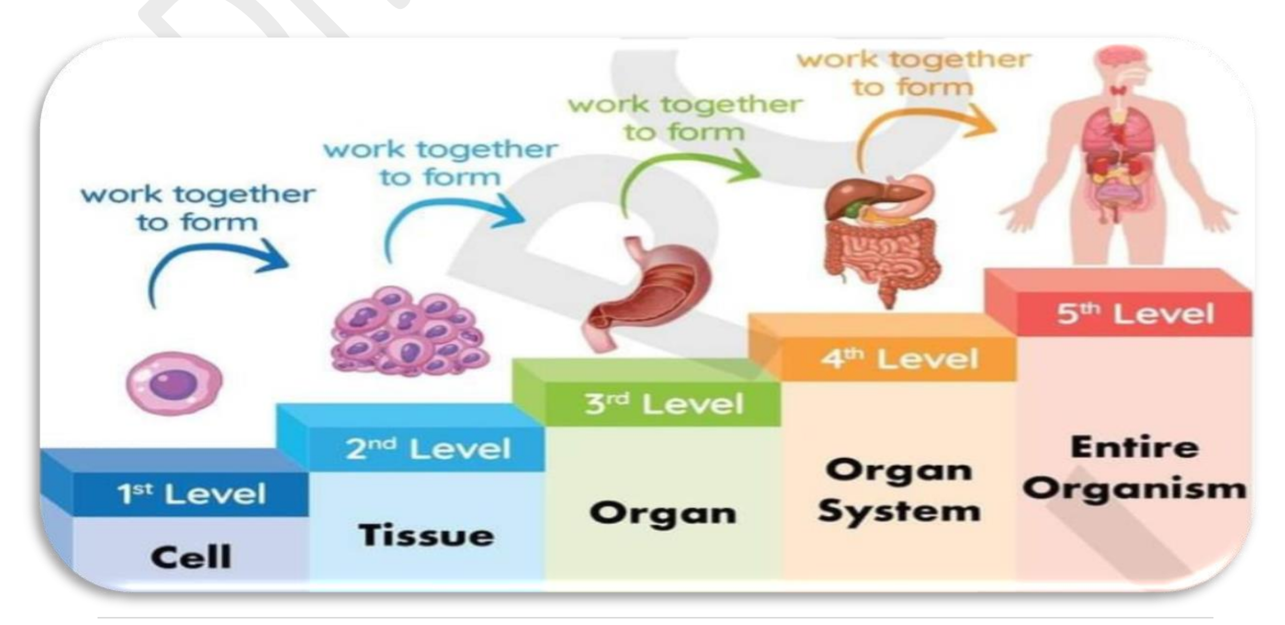
A plant has a variety of cell types that perform photosynthesis or collect water and mineral nutrients.

يختلف عدد الخلايا في جميع الكائنات الحية

- يملك الإنسان ما يقرب من ٤٠ تريليون خلية.
- للحيوانات مجموعة متنوعة من الخلايا، بما في ذلك خلايا العضلات، وخلايا العظام، وخلايا الدم.
- تقوم الأنواع المتخصصة من الخلايا النباتية بعملية البناء الضوئي، أو تجميع المياه والعناصر الغذائية.

Levels of Biological Organization

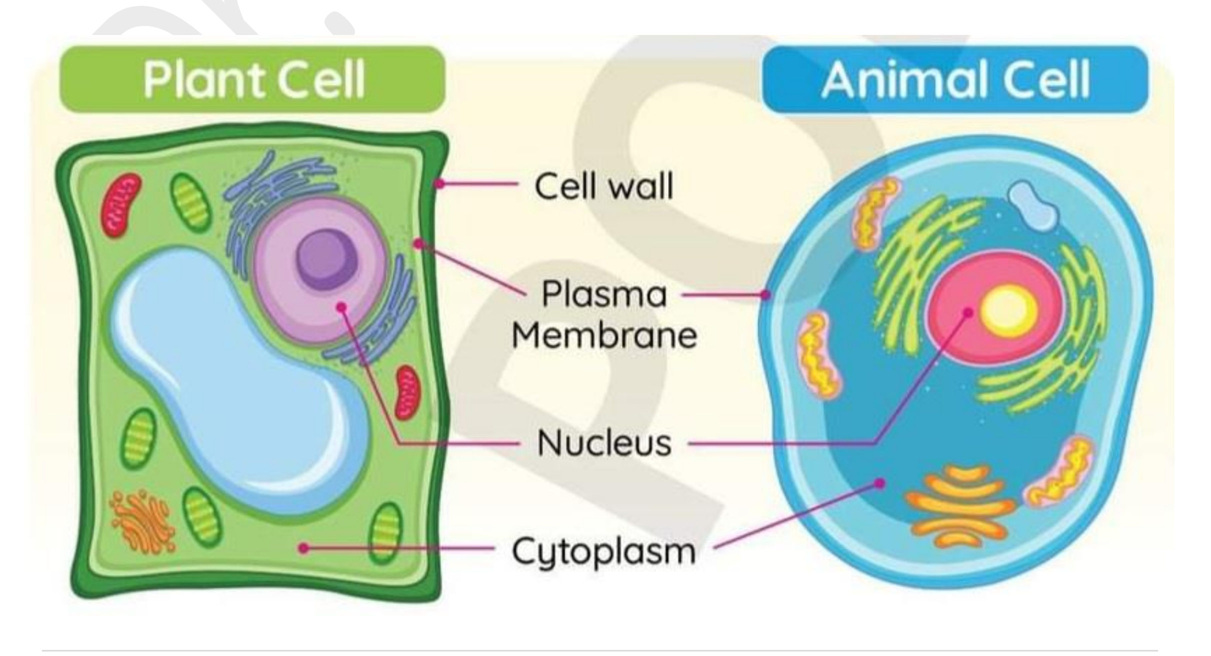
- The structure of most multicellular organisms is organized into **five levels**:



- Each level plays a specific role related to that organism's structure and function.

Level	Definition	Examples
Cell	The basic (smallest) unit of life.	Stomach cells
Tissue	A group of similar cells that share a common origin and perform the same function.	Stomach tissues
Organ	A group of tissues involved in performing a particular function.	Stomach
System	A group of organs that perform a specific function.	Digestive system
Entire organism	A group of systems that work together.	Human

Structure of the Cell



- Now, we are going to study some parts of the cell and their functions:

والآن سوف ندرس بعض أجزاء الخلية ووظائفها:

Cell wall

- **Location:** It surrounds the plant cell from outside.
- **Function:** It gives the cell a definite shape.

جدار الخلية:

- **الموقع**: يحيط بالخلية النباتية من الخارج.
- **الوظيفة**: إعطاء الخلية شكلا محددا.

Plasma (Cell) Membrane

- **Location**: It surrounds the cell (cytoplasm).
- **Function**: It protects the cell and regulates what can enter or leave it.

غشاء الخلية:

- **الموقع:** يحيط بالخلية (السيتوبلازم).
- **الوظيفة:** يحمي الخلية وينظم ما يدخل إليها أو يخرج منها.

Nucleus

- **Location**: It is located at the center of the cells.
- **Function**: It is the control center for the organelles.

النواة:

- **الموقع**: تقع في وسط الخلية.
- **الوظيفة**: مركز التحكم في العضيات.

Cytoplasm

- **Location**: It is located inside the membrane.
- **Function**: It supports the organelles.

السيتوبلازم:

- **الموقع**: يقع داخل الغشاء.
- **الوظيفة**: يدعم الخلايا.

Organelle

- It's a structure within the cell that has a special function.

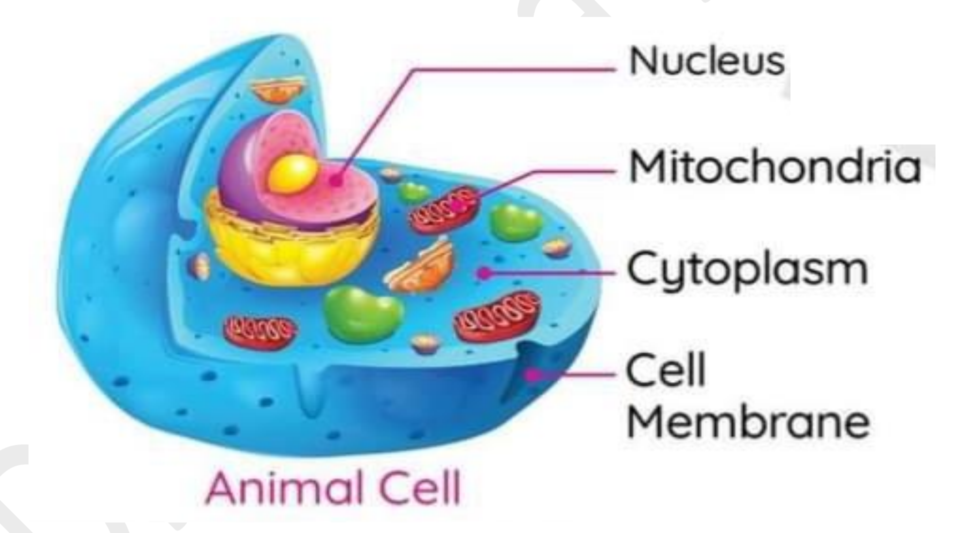
العضية: هو تركيب داخل الخلية له ووظيفة خاصة.

The Functions of Cell Parts

- Different cells have different structures.
- The cells of multicellular organisms can vary greatly.

Common characteristics:

- Most cells have cytoplasm, a cell membrane, a nucleus, and mitochondria.



Cell Membrane

- It is the outer lining of the cell.
- It controls which substances can enter or leave the cell.
- It is said to be "selectively permeable." Because some substances can pass through it, while others cannot.

Cytoplasm

- It is the gelatinous liquid inside the cells in which other cell parts float.

Nucleus

- It is responsible for controlling cell activities, such as:
  1) Making proteins   2) Cell division

Mitochondria

- They are powerhouses that supply the cell with energy.
- Cellular respiration takes place in it.

  Cellular respiration:
  - It's a process of using oxygen gas to get chemical energy from food.

الغشاء الخلوي:

- هو البطانة الخارجية للخلية.
- يساعد على التحكم في المواد التي يمكن أن تدخل إلى الخلية أو تخرج منها.
- يقال إن الغشاء الخلوي: " **انتقائي النفاذية** " لأن بعض المواد يمكن أن تمر من خلاله، بينما يمنع البعض الآخر.

السيتوبلازم:

- هو سائل **هلامي** داخل الخلايا والذي تطفو فيه مكونات الخلية الأخرى.

النواة:

- مسئولة عن التحكم في أنشطة الخلية مثل:
  1) تكوين البروتينات   2) الانقسام لتكوين خلايا جديدة.

الميتوكوندريا:

- هي مراكز الطاقة للخلية.
- يحدث التنفس الخلوي في الميتوكوندريا.

التنفس الخلوي:

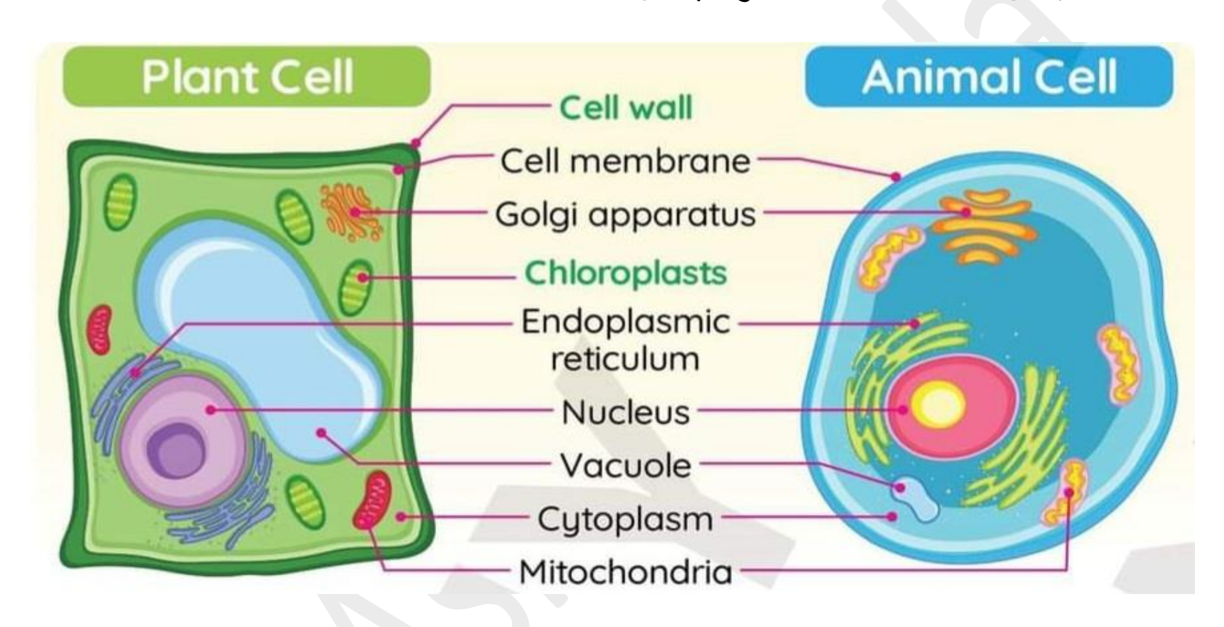
- هو عملية استخدام الأكسجين للحصول على الطاقة من الغذاء.



Comparing Plant and Animal Cells

- Plant cells and animal cells have **similarities** and **differences**.
- The following two figures represent the structure of each cell.

- الخلايا النباتية والحيوانية لديها أوجه تشابه واختلاف.
- يمثل الشكلان التاليان تركيب كل خلية.

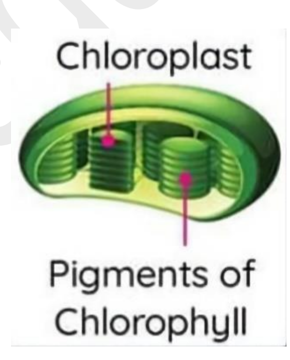


P.O.C	Animal cells الخلية الحيوانية	Plant cells الخلية النباتية
Differences	They don't have a cell wall or chloroplast. ليس لديها جدار خلوي أو بلاستيدة خضراء	They have a cell wall and a chloroplast. لديها جدار خلوي وبلاستيدة خضراء
Similarities	Both of them have common organelles, such as: 1)Cell membrane 2) Cytoplasm 3) Nucleus 4) Mitochondria 5) Endoplasmic reticulum 6) Golgi apparatus 7) Vacuole	

	كلاهما لديه عضيات مشتركة مثل: 1)غشاء الخلية 2) السيتوبلازم 3) النواة 4) الميتوكوندريا 5) الشبكة الإندوبلازمية 6) جهاز جولجي 7) الفجوات

Differences Between Plants and Animals

Plants



- Under the microscope, the plant cell has tiny grains.
- These grains are green.
  - Because they contain the pigment of chlorophyll.

How does the plant make its own food?

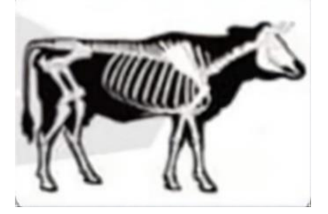
1. The **pigment chlorophyll** absorbs energy from sunlight.
2. The **chloroplast** uses energy to make food for the plant.

- إذا نظرت إلى الخلية النباتية تحت الميكروسكوب، فيمكنك رؤية أنها تحتوي على حبيبات صغيرة خضراء في أكياس.
- تتكون ورقة النبات من بلاستيدات تحتوي على حبيبات خضراء تسمى صبغة الكلوروفيل .
- هذه الحبيبات خضراء لأنها تحتوي على صبغة الكلوروفيل.

كيف يتمكن النبات من صنع غذائه بنفسه ؟

- تمتص **صبغة الكلوروفيل** الطاقة من ضوء الشمس
- تستخدم **البلاستيدات الخضراء** تلك الطاقة لصنع غذاء النبات.

Animals


Bones in cows



- Animal cells do not have **chloroplasts** or a **cell wall**.
- **Animals can't make their own food.**
  - Because they don't have **chloroplasts**.
- **Animals do not take on the rigid structures that plants do.**
  - Because they don't have **cell walls**.
- Animals have other ways of keeping their shape.
  - Some animals have **bones**.
  - Insects have an **exoskeleton** (a hard, shell-like covering).

- لا تحتوي الخلايا الحيوانية على **بلاستيدات خضراء** أو **جدار خلوي**.
- **لا تتمكن الحيوانات من صنع غذائها بنفسها**
  - لعدم وجود بلاستيدات خضراء في خلاياها.
- **لا تتخذ الحيوانات نفس الهياكل التي تتخذها النباتات**
  - لأن الخلايا الحيوانية لا تحتوي على جدار خلوي.
- لدى الحيوانات طرق أخرى للحفاظ على شكلها.
  - بعض الحيوانات لديها **عظام**
  - والبعض الآخر مثل: الحشرات لها ظهر صلب يشبه الصدقة يسمى **الهيكل الخارجي**

First: Different cell organelles:

Organelle	Illustration	Function
Cell Wall		It is found in the plant's cell only. It's the rigid outside material that surrounds the plant cells. It gives them a definite shape. جدار الخلية: - توجد في النباتات فقط. - هي المادة الخارجية الصلبة التي تحيط بخلايا النبات. - تعطي النبات شكلا محددا.
Chloroplast		It is found in the plant's cell only. It contains chlorophyll and carries out the **photosynthesis process**. **البلاستيدة الخضراء:** - توجد في النباتات فقط. - تحتوي على مادة الكلوروفيل وتقوم بعملية البناء الضوئي.

Second: Common cell organelles:

→ Both plant and animal cells have common organelles to **control**, **organize**, and **maintain** the cell.

→ These functions are mainly done by the **cell membrane**, **cytoplasm**, **cell nucleus**, **mitochondria**, **endoplasmic reticulum**, **Golgi apparatus**, and **vacuole**.

- تحتوي كل من الخلايا النباتية والحيوانية على عضيات مشتركة للتحكم في الخلية وتنظيمها والحفاظ عليها.
- تتم هذه الوظائف بشكل رئيسي عن طريق غشاء الخلية، السيتوبلازم، نواة الخلية، الميتوكوندريا، الشبكة الإندوبلازمية، جهاز جولجي، و الفجوة.

Organelle	Illustration	Function
Cell membrane		It is the surrounding layer of the cell. It controls what materials enter and leave the cell. **غشاء الخلية:** - الطبقة المحيطة بالخلية التي تتحكم في المواد التي تدخل إلى الخلية وتخرج منها.

Cytoplasm		It is the <u>gelatinous liquid</u> inside the cells in which other cell parts float. **السيتوبلازم:** - هو السائل الهلامي داخل الخلايا والذي تطفو فيه مكونات الخلية الأخرى.
Cell Nucleus		It controls the functions inside the cell, such as: 1. Making proteins 2. Cell division **نواة الخلية:** - تتحكم النواة في الوظائف داخل الخلية مثل: إنتاج البروتين، وانقسام الخلية
Mitochondria		It converts <u>sugar</u> into <u>energy</u> for the cell. **الميتوكوندريا:** تحول السكر إلى طاقة للخلية.
Endoplasmic Reticulum		It helps in <u>assembling</u> and <u>transporting</u> proteins. **الشبكة الإندوبلازمية:** - تساعد في جمع ونقل البروتينات.

Golgi Apparatus		- It helps <u>package</u> nutrients within vital products inside the cell. - It helps <u>transport</u> nutrients outside the cell. **جهاز جولجي:** - يساعد على <u>تعبئة</u> وتغليف العناصر الغذائية داخل الخلية. - يساعد على <u>نقل</u> المواد الغذائية خارج الخلية.
Vacuole		- They are <u>saclike</u> structures used for the storage of nutrients, water, and waste. - In plant cells, large vacuoles contain water. **الفجوة العصارية:** - تركيب يشبه <u>الكيس</u> ويستخدم لتخزين العناصر الغذائية والمياه والفضلات. - في الخلايا النباتية تحتوي الفجوات الكبيرة على الماء.

<u>Give reason for:</u>

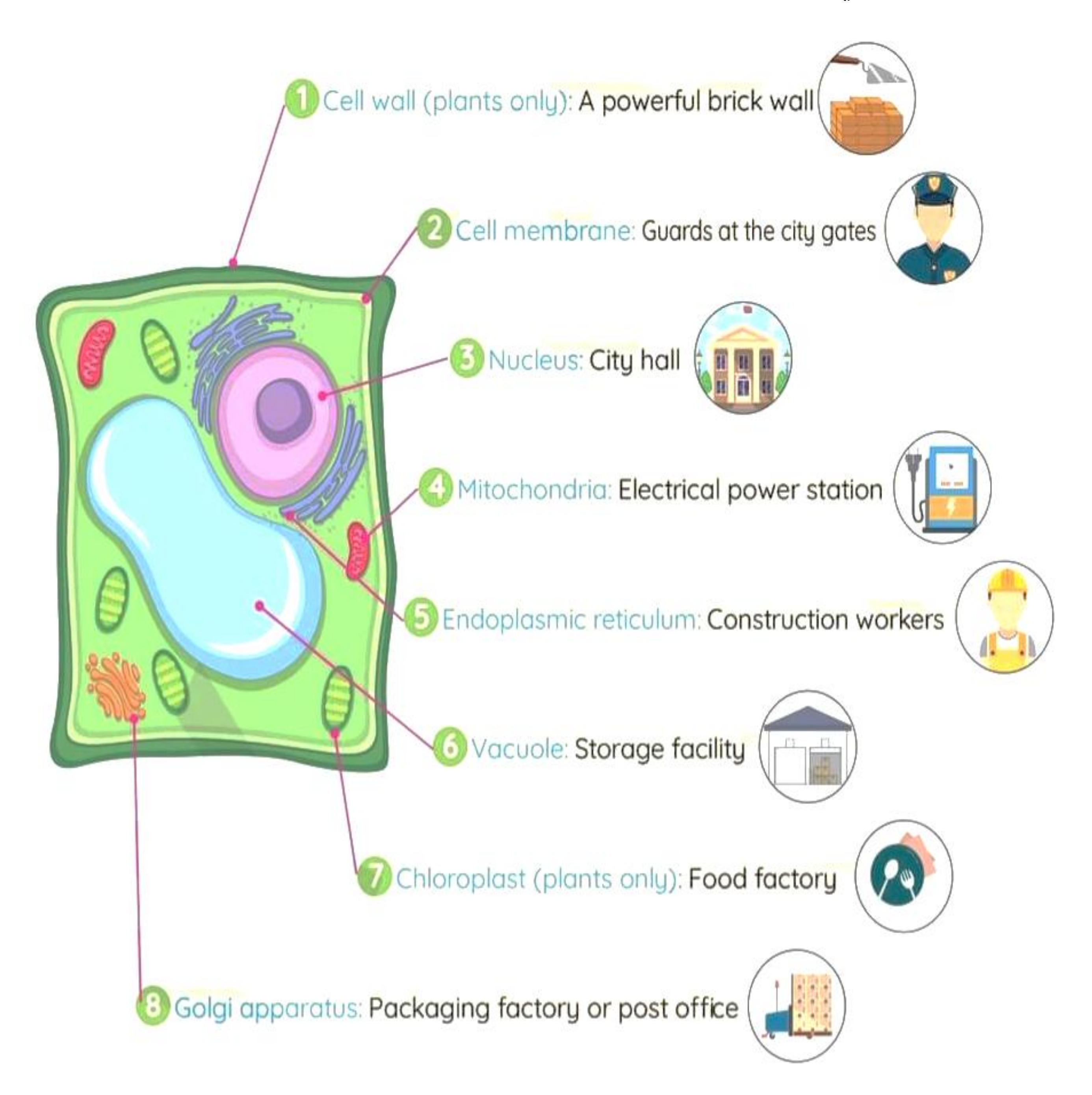
- The vacuole is larger in the plant cell than in the animal cell.
  - Because the plant stores a large amount of water in the vacuole.

Planning a Cell City

- Suppose you are an engineer, and you have been asked to design a cell city model to display different organelles.

التخطيط لمدينة الخلية:

- لنفترض أنك مهندس، وقد طلب منك تصميم نموذج لمدينة خلوية لعرض العضيات المختلفة.



1) الجدار الخلوي (في النباتات فقط): جدار قوي من الطوب.
2) الغشاء الخلوي: حراس بوابات المدينة.
3) النواة: مجلس إدارة المدينة.
4) الميتوكوندريا: محطة توليد الكهرباء
5) الشبكة الإندوبلازمية: عمال البناء.
6) الفجوة العصارية: صومعة التخزين
7) البلاستيدة الخضراء (في النباتات فقط): مصنع الغذاء.
8) جهاز جولجي: مصنع التعبئة أو مكتب البريد.

- ***There are two structures in plant cell that are not found in the animal cell, which are:***
  1. The stone wall surrounding the city (that represents the **cell wall**).
  2. The food factory (that represents the **chloroplast**).

هناك تركيبان في الخلية النباتية لا يوجدان في الخلية الحيوانية، وهما:
- السور الحجري المحيط بالمدينة (الذي يمثل **جدار الخلية**).
- مصنع الغذاء (الذي يمثل **البلاستيدات الخضراء**).

Lesson 5 & 6 Careers and Cell Biology

- Cells are very tiny, where the diameter of an animal cell is about (0.001 cm).

Cell biologists **are scientists who study cells.**

- Cell biologists use microscopes to magnify cells, so they seem larger.



- ***Cell biologists work in laboratories and do experiments to study:***
  - How cells work inside the living organisms.
  - How cells respond to different variables.

وظائف وبيولوجيا الخلية:

- الخلايا صغيرة جدًا حيث يبلغ قطر الخلية الحيوانية حوالي (0.001 سم).

علماء الأحياء الخلوية **هم العلماء الذين يدرسون الخلايا.**

- يستخدم علماء الأحياء الخلوية المجاهر لتكبير الخلايا بحيث تبدو أكبر.

- ***يعمل علماء الأحياء الخلوية في المختبرات ويقومون بتجارب لدراسة:***
  - كيفية عمل الخلايا داخل الكائنات الحية.
  - كيف تستجيب الخلايا للمتغيرات المختلفة.

Cell biologists analyze data and present their conclusions to other researchers, where:

يقوم علماء الأحياء الخلوية بتحليل البيانات وتقديم استنتاجاتهم إلى باحثين آخرين، حيث:

Some other cell biologists work in agriculture to study how plant cells respond to different environmental factors.

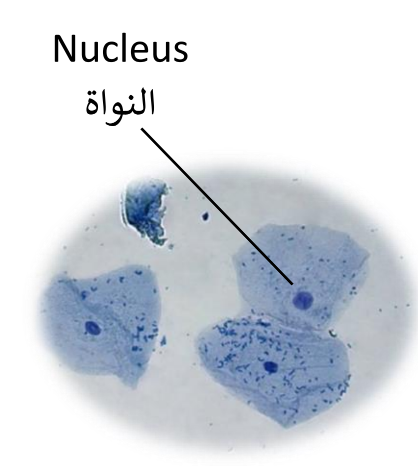
يعمل بعض علماء الأحياء الخلوية الآخرين في الزراعة لدراسة كيفية استجابة الخلايا النباتية للعوامل البيئية المختلفة.

Some cell biologists work with doctors to watch how cells can work to repair body parts or how cells respond to different medicines.

يعمل بعض علماء الأحياء الخلوية مع الأطباء لمراقبة كيفية عمل الخلايا لإصلاح أجزاء الجسم أو كيفية استجابة الخلايا للأدوية المختلفة.

Staining Cells:

- Cells are usually clear and colorless, so it is hard to see their structures under microscope.
- Stains (dyes) are used to add color and make the cell's structures more visible.



Cheek cells under microscope
خلايا الخد تحت المجهر

- There are different types of stains, where some stains are used to highlight one part of cells and make it more visible such as "**methylene blue**" dye that helps you see the nucleus as a blue area in a sample of cheek lined membrane cells.

تلطيخ الخلايا:

- الخلايا عادة ما تكون واضحة وعديمة اللون، لذلك من الصعب رؤية بنيتها تحت المجهر.
- تستخدم البقع (الأصباغ) لإضافة اللون وجعل هياكل الخلية أكثر وضوحا.
- هناك أنواع مختلفة من البقع، حيث تستخدم بعض البقع لإبراز جزء واحد من الخلايا وجعله أكثر وضوحا مثل صبغة "أزرق الميثيلين" التي تساعدك على رؤية النواة كمنطقة زرقاء في عينة من خلايا الغشاء المبطن بالخد.

Cells in 3D

Scientists have built a microscope that shows the cell in 3D, which means that they can see the top, sides and layers of a cell, where :

The 3D microscope takes pictures of a cell in layers.



Then, a computer puts these layers together.



Finally, colors are added to the formed image.

The 3D microscope can help:

- Cell biologists learn more about cell components.
- Doctors to treat cancer which is caused by cells that divide too quickly.



الخلايا ثلاثية الأبعاد:

قام العلماء ببناء مجهر يظهر الخلية بشكل ثلاثي الأبعاد، مما يعني أنهم يستطيعون رؤية أعلى وجوانب وطبقات الخلية، حيث:

- يلتقط المجهر ثلاثي الأبعاد صوراً للخلية على شكل طبقات.
- ثم يقوم الكمبيوتر بتجميع هذه الطبقات معًا.
- وأخيرا، يتم إضافة الألوان إلى الصورة المشكلة.

يمكن أن يساعد المجهر ثلاثي الأبعاد في:

- يتعلم علماء الأحياء الخلوية المزيد عن مكونات الخلية
- الأطباء يعالجون السرطان الذي يسببه انقسام الخلايا بسرعة كبيرة.

Unit 1 – concept 1
(The cell as a system)

cell	خلية	Taking in	يأخذ
Building blocks	وحدة بنائية	Release	يتخلص من
Microscope	مجهر	Unicellular organisms	كائنات أحادية الخلية
Unfertilized	غير مخصب	Multicellular organisms	كائنات متعددة الخلايا
Complex	معقد	Characteristics	مميزات
Cell needs	احتياجات الخلية	Function	وظيفة
Unaided eye	العين المجرّدة	Cell (plasma) membrane	غشاء الخلية
Reproducing	التكاثر	Regulate	ينظّم
Bacteria	بكتيريا	System	جهاز
Basic unit	وحدة أساسية	Eyedropper	قطارة
Distilled water	ماء مقطّر	Glass slide	شريحة زجاجية
Coverslip	غطاء الشريحة	Compound microscope	مجهر مركب
Eyepiece	العدسة العينية	Tube	الإسطوانة
Coarse focus	الضابط الكبير	Fine focus	الضابط الصغير
Objective lenses	العدسات الشيئية	Arm	الذراع
Stage	المنصة	Stage clip	مثبت الشريحة
Base	القاعدة	Illuminator	مصدر الضوء
Focal length	البعد البؤري	Magnify	يكبّر
Muscle cells	خلايا العضلات	Bone cells	خلايا العظم

Blood cells	خلايا الدم	Skin cells	خلايا الجلد
Biological	حيوي	Organization	تنظيم / ترتيب
Tissue	نسيج	Organ	عضو
Structure	تركيب	Cell wall	جدار الخلية
Surround	يحيط	Nucleus	النواة
Cytoplasm	السيتوبلازم	Organelle	عضيّة
Definite shape	شكل محدد	Control	يتحكم
Mitochondria	الميتوكوندريا	Vacuole	الفجوة
Endoplasmic reticulum	الشبكة الإندوبلازمية	Golgi apparatus	جهاز جولجي
Chloroplast	البلاستيدة الخضراء	Chlorophyll pigment	صبغة الكلوروفيل
Selective permeability	النفاذية الاختيارية	Gelatinous	جيلاتيني
Outer lining	البطانة الخارجية	Powerhouses	مراكز الطاقة
Cellular respiration	التنفس الخلوي	Similarities	تشابهات
Exoskeleton	الهيكل الخارجي	Differences	اختلافات
Photosynthesis	البناء الضوئي	Organize	ينظّم
Maintain	يخافظ على	Cell division	انقسام الخلية
Assembling	جمع	Transporting	نقل
Package	تعبئة	Saclike	يشبه الكيس
Construction workers	عمّال البناء	Storage facility	صومعة التخزين

Food factory	مصنع الغذاء	Packaging factory	مصنع التعبئة
City hall	مجلس إدارة المدينة	Cell activities	أنشطة الخلية
diameter	قطر	variables	متغيرات
experiments	تجارب	stains / dyes	صبغات
layers	طبقات	cell biologists	علماء الخلية
laboratories	معامل	respond	يستجيب
analyze	يحلّل	researchers	باحثين
agriculture	زراعة	cheek	الخد
treat	يعالج	cancer	سرطان

Unit 1 – concept 1 – questions

Lesson 1

Choose the correct answer:

1) The ……………… is the building unit of a living organism's body.
   a. brick b. cell c. organ d. blood

2) Humans are ……………….. organisms.
   a. unicellular c. multicellular
   b. prokaryote d. simple

3) An unaided human eye can see an object ………… millimeters long.
   a. 0.01 b. 0.005 c. 0.5 d. 0.001

4) An unaided human eye can't see all the following, except …………………..
   a. an onion's cell c. a bacterial cell
   b. a skin's cell d. a bird's unfertilized egg cell

5) A living organism grows and reproduces by increasing the ……………. of its body cells.
   a. number b. size c. volume d. length

6) All the following are multicellular living organisms, except ……………..
   a. a bean plant b. a cat c. bacteria d. a human

7) All the following are from the basic needs for the cell, except …………….
   a. Water b. oxygen c. food d. carbon dioxide

8) The …………….. regulates the substances that pass in or out of the cell.
   a. Nucleus   c. cell wall
   b. plasma membrane   d. cytoplasm

9) Which statement about the cells is false?
   a. All living organisms are composed of cells.
   b. All cells come from existing cells.
   c. Most cells are microscopic in size.
   d. All cells have a nucleus.

<u>Put (√) or (X):</u>

1- Most cells are usually very small. ( )

2- The unaided human eye can see a bacteria cell. ( )

3- Different living organisms have similar cells that have similar functions. ( )

4- Increasing the number of the living organism's cells occurs during reproduction process only. ( )

5- The cell membrane allows water to enter the cell, but not to leave it. ( )

6- There must be a water imbalance at the two sides of the cell membrane, so that the cell won't burst. ( )

7- The cell membrane allows only the needed substances to enter the cell. ( )

8- Scientists can use a telescope to see the very small cells. ( )

9- An unfertilized bird egg contains more than one egg cell.

( )

10- Multicellular organisms consist of only one single cell, such as the plant cell. ( )

Write the scientific term:

1. They are the building units of life on Earth. (………………..)
2. They are living organisms, and their bodies consist of more than one cell. (…………………………………………………)
3. They are living organisms, and their bodies consist of only one cell. (…………………………………………………)
4. It's a device used to see very small cells as a plant cell. (………………………………..)
5. It controls the substances that enter or leave the cell. (…………………………………)
6. It's a gas which the cell needs to get energy and perform its vital activities. (…………………………………….)
7. They're materials released from the cell. (…………………………)
8. It's a liquid material that is necessary for the cell to do its function well. (……………………………)

Complete the following sentences using the words between the brackets:

(**nucleus - shape – oxygen - energy - cell membrane – size – waste products – food**)

1) Cells in our body are different in …………………….. and …………………….. because they have different functions.
2) All cells are composed of a …………………….. .
3) A cell takes in ………………… and ………………. to get …………………… but it releases
4) Not all cells contain …………………..

Correct the underlined words:

1- Most cells are very **large**, so we can see them with our naked eyes. (……………………..)

2- A cell is a **simple** structure that carries out its vital activities. (………………………..)

3- Bacteria are **multicellular** living organisms. (…………………………….)

4- Living organisms can be divided into multicellular and unicellular organisms according to the **size** of cells in their bodies. (……………………)

5- The cell will **shrink** when too much water keeps entering it. (…………………….)

Cross out the odd word:

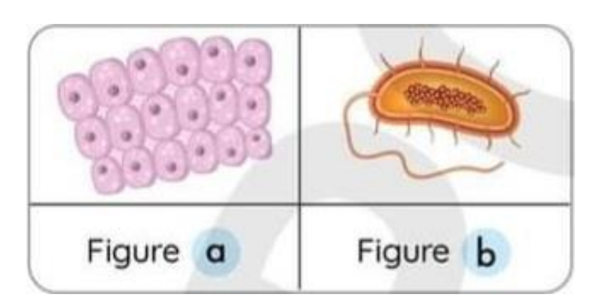
a) Plant - Bacteria - Animal - Human
b) A skin cell - A plant cell - An animal's cell - A bird's unfertilized egg cell
c) Oxygen Water - Carbon dioxide - Food

Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. A cell membrane 2. A bird's unfertilized egg cell 3. Bacterium 4. A skin cell	a. is smaller than 0.005 mm long. b. length ranges between 0.005 to 0.1 mm. c. controls the amount of water that enters the cell. d. is a very large cell.

Study the following figures, then complete the sentences below:

1) Figure ……… represents a bacterial cell, as it consists of …………………… cell(s).
2) Figure ……… represents the cells of a human skin.



Give reasons for:

1. The cell provides the structure of the living organism's body.

……………………………………………………………………………………………

……………………………………………………………………………………………

2. A plant is considered a multicellular organism.

……………………………………………………………………………………………

……………………………………………………………………………………………

3. Bacteria are considered unicellular organisms.

……………………………………………………………………………………………

……………………………………………………………………………………………

4. You can see a bird's unfertilized egg, but you can't see your skin cell without a microscope.

……………………………………………………………………………………………

……………………………………………………………………………………………

5. The cell membrane is very important for the cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

6. The cells of the same living organisms are different in shape and size.

……………………………………………………………………………………………

……………………………………………………………………………………………

7. The amount of water must be balanced at the two sides of the cell membrane.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens if:

1- The cell can't get its basic needs.

……………………………………………………………………………………………

……………………………………………………………………………………………

2- The cell membrane is absent in an animal cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

3- Too much water enters the cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

Lesson 2

Choose the correct answer:

1) …………………… was the first scientist to use the word "cell".
   a. Newton b. Hooke c. Edison d. Einstein

2) The nucleus was discovered during an observation of an enormous ……………….. cell.
   a. animal b. bacterial c. human d. plant

3) Scientists concluded that the ……………….. is the basic unit of the organism's structure.
   a. cell   b. organ   c. tissue   d. system

4) All the following are form the parts of a compound microscope, except the ………………..
   a. eyepiece   c. illuminator
   b. objective lenses   d. objective mirrors

5) The membrane of an onion consists of similar units called …………………
   a. cells   b. nuclei   c. organs   d. tissues

6) You can change the power of magnifying of a microscope by using another …………………..
   a. objective lens   b. eyepiece   c. mirror   d. arm

Put (√) or (X):

1. Developed microscopes have allowed scientists to make new discoveries. (   )
2. Sometimes a single cell exists on its own as in bacteria. (   )
3. The membrane of an onion consists of different units called cells. (   )
4. The cell in an onion membrane contains many components. (   )
5. A leaf cell and a red blood cell can exist in the same organism. (   )
6. Scientists must be open to new ideas about how cells work. (   )

Write the scientific term:

1- It's a device that can be used to magnify cells.

(…………………………………….)

2- They're the identical building units of living organisms.

(………………………..)

3- It's the type of water added on the samples in microscopes.

(………………………………………………..)

4- It's a part of the microscope through which you look at the sample. (…………………………………………..)

5- It's a part of the microscope that changes the magnifying power. (…………………………………………….)

Correct the underlined words:

I. A complex living system contains **one cell**.

(…………………………………….)

II. We use drops of **tap** water on the sample in a microscope. (……………………………)

III. We look at the sample through the **objective lens** of the microscope. (…………………………………)

IV. We change the magnifying power of the microscope by using a different **mirror**. (…………………………….)

Cross out the odd word:

- ❖ Objective lens - Stage clips - Eyepiece - Distilled water
- ❖ A leaf cell - A red blood cell - A skin cell - A bird's unfertilized egg cell

Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1) The cell 2) A compound microscope 3) Changing the objective lens	a) changes the magnifying power of the microscope. b) is the building unit of the living organism's structure. c) can be used to examine a thin membrane of an onion.

Answer the following questions:

Study the following three figures that represent the samples under a compound microscope, then put true or false:

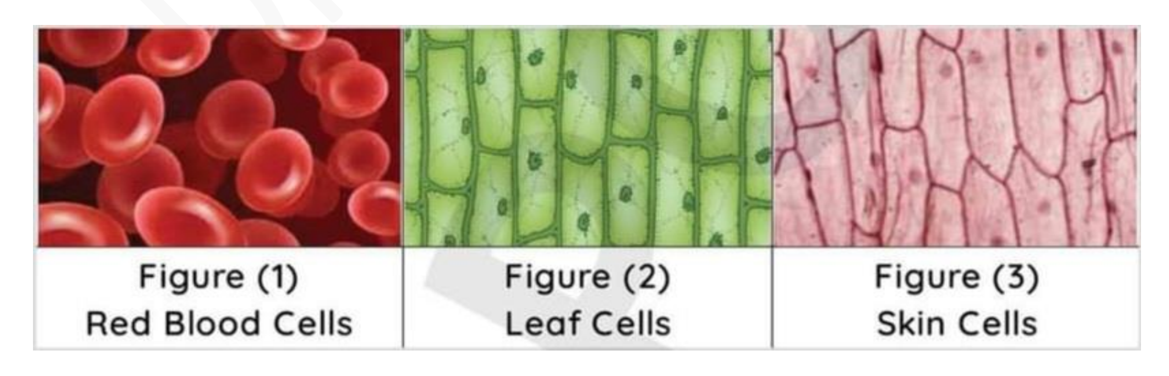


Figure (1) Red Blood Cells — Figure (2) Leaf Cells — Figure (3) Skin Cells

1. All the three samples represent microscopic cells. (   )
2. The three samples have different functions. (   )

3. All the three samples can exist in the same organism. ( )
4. Each figure represents the basic units that form an organism. ( )

The following diagram represents the ………………………….

Write the following labels:

a) …………………………………..

b) …………………………………..

c) …………………………………..

d) …………………………………..

e) …………………………………..

<u>Give a reason for:</u>

The microscope is very important for the biologists and botanists.

……………………………………………………………………………………………

……………………………………………………………………………………………

<u>What happens if:</u>

The microscope wasn't invented.

……………………………………………………………………………………………

……………………………………………………………………………………………

Lesson 3

Choose the correct answer:

1) The human body is composed of ………………cells.
   a. 40 hundred b. 40 thousand c. 40 million d. 40 trillion

2) All the following are from the cells found in the animal body, except the ………………….
   a. blood cells c. bone cells
   b. xylem cells d. muscle cells

3) A/An ………………… is a unicellular simple living organism.
   a. human b. animal c. bacterium d. plant

4) The tissue is a set of similar …………………….
   a. systems b. cells c. organs d. organelles

5) All the following are considered organs, except the ……………….
   a. lung b. heart c. stomach d. muscle tissue

6) The systems that keep a multicellular organism alive are divided into …………….. levels.
   a. two b. three c. four d. five

7) All the following organelles are common in plants and animals cells, except the ……………….
   a. cytoplasm c. nucleus
   b. cell wall d. cell membrane

8) Cell's components are suspended in the …………………..
   a. Nucleus c. cytoplasm
   b. cell wall d. cell membrane

9) The ……………… surrounds the plant cell from outside and gives it a definite shape.
   a. Nucleus   c. cytoplasm
   b. cell wall   d. cell membrane

10) The ……………. is a liquid that fills the cavity of the cell and is surrounded by the cell membrane.
   a. Nucleus   c. cytoplasm
   b. cell wall   d. mitochondrion

11) The ……………. surrounds the cytoplasm and controls the substances that enter or leave the cell.
   a. cell wall   c. plasma membrane
   b. nucleus   d. mitochondrion

<u>Put (√) or (x):</u>

1- The number of cells in plants and animals varies from a species to another. ( )
2- A stomach consists of a group of tissues. ( )
3- The liver is a tissue, while the heart is an organ. ( )
4- The respiratory system consists of a set of cells. ( )
5- The cell is the smallest building unit of a living organism. ( )
6- Both the mitochondrion and plasma membrane are found in plant and animal cells. ( )
7- The cell membrane surrounds the plant cell from outside. ( )

8- Nucleus, mitochondria and cell membrane float in the cytoplasm. ( )

9- The outermost layer of the cell is called "cell membrane". ( )

<u>Write the scientific term:</u>

1. It is a structure inside the cell that has a specific function. (………………………………)
2. It is a set of tissues forming a structural unit to perform a specific function. (………………………………………)
3. It is a group of identical cells that perform the same function. (…………………………………)
4. It is a group of organs that perform a specific function. (…………………………………)
5. It's a liquid in which the cell's organelles float. (………………………………)
6. It's a feature through which the cell membrane determines which substances will pass through. (………………………………………………………………..)
7. It's the outer lining of the cell that surrounds the cytoplasm. (………………………………………)
8. It's the structure that controls the cell activities. (………………………………….…)
9. They are the powerhouses of energy in the cell.

(……………………………………..)

10. It's a process of using oxygen to get chemical energy from food in the cell. (…………………………………….)

Complete the following sentences using the words between the brackets:

(cells - similar - nucleus - organelles – tissues)

1) A cell consists of ……………………… that are functioning in ……………………………… ways to maintain the cell.
2) An organ is composed of a set of ……………………….. that are composed of a group of ……………………………..
3) The ……………………… in the cell is responsible for cell division.

Correct the underlined words:

A) A system is composed of a set of **tissues** that work together.

(……………………..)

B) The stomach and lung are considered **systems**.

(……………………..)

C) The liver consists of a group of **organelles**.

(………………………)

D) The **cytoplasm** is the control center of the cell.

(…………………………….)

E) The **cell wall** is a semi-permeable membrane that controls the substances entering the cell.

(………………………………………)

F) **Photosynthesis process** takes place inside the mitochondria.

(……………………………………)

G) The **plant** cell is the building unit of the human body.

(……………………)

Cross out the odd word:

- Cell membrane - Cell wall - Nucleus – Cytoplasm
- Digestive system - Respiratory system - Circulatory system - Heart
- Blood cell - Stomach - Lung - Liver

Choose from column (A) what suits it in column (B):

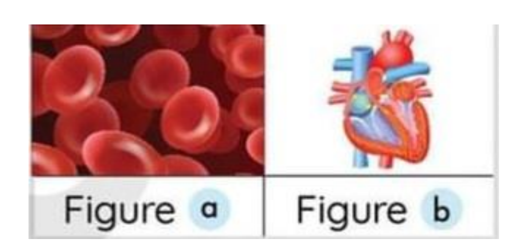
Column (A)	Column (B)
1- Nucleus 2- Cell membrane 3- Cell wall	a- is the control center of the cell. b- supports the plant cell from outside. c- controls the substances passing into or out of the cell.

Answer the following questions:

Study the following three figures, then answer:

A) Figure (   ) consists of tissues.

B) Figure (   ) represents a group of cells.



The following diagram represents the ………………………….

Write the following labels:

a) …………………………………………..

b) …………………………………………..

c) …………………………………………..

d) …………………………………………..



Give reasons for:

❖ All organs of the digestive system work together.

……………………………………………………………………………………………

……………………………………………………………………………………………

❖ The cell membrane has the selective permeability property.

……………………………………………………………………………………………

……………………………………………………………………………………………

❖ The nucleus has an important role for the cell.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

❖ The mitochondrion has an important role for the cell.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

What happens if:

1) The cell wall in the plant cell is absent.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

2) The mitochondria are absent from an animal cell.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Lesson 4

Choose the correct answer:

1. Which of the following is found in both plant and animal cells?
   a. Cell membrane — c. Large, water-filled vacuole
   b. Cell wall — d. Chloroplast

2. Which two organelles are involved in transportation?
   a. Nucleus and endoplasmic reticulum
   b. Mitochondria and nucleus
   c. Chloroplast and Golgi apparatus
   d. Endoplasmic reticulum and Golgi apparatus

3. Photosynthesis process takes place in the ………………… while cellular respiration takes place in the ……………….
   a. nucleus – cytoplasm — c. mitochondria – chloroplast
   b. mitochondria – nucleus — d. chloroplast - mitochondria

4. ……………………. are unique structures that exist only in the plant cell.
   a. Mitochondria — b. Nuclei — c. Vacuoles — d. Chloroplasts

5. The plant cell is distinguished from the animal cell by the presence of ………………… and …………………….
   a. chloroplasts - nucleus — c. chloroplasts - cell wall
   b. nucleus - cell wall — d. nucleus - cytoplasm

6. The ………………… release(s) energy to power the cell.
   a. Mitochondria — c. nucleus
   b. cell wall — d. cell membrane

7. ………………… is the command center of the cell.
   a. Chloroplast c. Nucleus
   b. Mitochondrion d. Cell membrane

8. All the following can be stored in the cell vacuole, except …………………………
   a. waste b. cytoplasm c. water d. nutrients

9. The ………………. transports proteins in the cell.
   a. golgi apparatus c. endoplasmic reticulum
   b. Mitochondrion d. nucleus

10. The ………………… controls the substances that enter or leave the cell.
    a. cytoplasm b. cell wall c. nucleus d. cell membrane

11. The envelopes of the cell used for transporting materials are the ……………….
    a. nuclei c. mitochondria
    b. chloroplasts d. Golgi bodies

12. The …………….. in the cell resembles the powerful brick wall of a city.
    a. Nucleus b. cell wall c. cytoplasm d. cell membrane

13. Golgi apparatus can ………………… inside the cell.
    a. transport protein c. makes proteins
    b. package waste d. a and b

Put (√) or (x):

1- Both plant and animal cells have common organelles to organize and maintain the cell. ( )

2- Chloroplasts release energy from the food, but mitochondria produce energy from the sunlight. ( )

3- Chloroplasts have yellow grains called chlorophyll pigment. ( )

4- The outermost layer of a plant cell is the cell wall, but the outermost layer in an animal cell is the cell membrane. ( )

5- The animal cell has a definite shape, while the plant cell has an indefinite shape. ( )

6- Golgi apparatus can transport materials inside cells, but it can't transport them outside them. ( )

7- The plant cell has a larger vacuole than that of the animal cell. ( )

8- The cell membrane looks like guards at the gates of a city. ( )

Write the scientific term:

1) They help plant and animal cells control, organize, and maintain the cell. (……………………………….)

2) It controls the functions inside the cell and cell division. (………………………………….)

3) They are saclike organelles that store nutrients, water, and waste. (……………………………………)

4) It's the fluid found in the cell that holds its organelles. (………………………………………..)

5) They're organelles in the plant cell that convert light energy into sugar. (………………………………………..)

6) They're organelles in the plant cell that power the cell with energy. (………………………………………..)

7) It's a process that occurs inside the chloroplast. (……………………………………)

8) It's a process that occurs inside the mitochondria. (……………………………………)

<u>Complete the following sentences using the words between the brackets:</u>

(Golgi apparatus - sugar - Mitochondria – chloroplasts – exoskeleton - chlorophyll - Bones - endoplasmic reticulum)

- ……………………… support(s) the fish body shape, while a/an …………………………. supports that of insects.
- In the photosynthesis process, ………………………… absorb(s) sunlight, where …………………………… use(s) it to make the plant's food.
- ……………………… transport(s) proteins produced by the ……………………………… through the cell.

- ………………………….. convert(s) ……………………….. into energy that is needed for the cell activities.

Correct the underlined words:

- Chloroplasts have a green color due to the presence of **iodine** pigment. (……………………………)
- A plant cell has a rigid shape due to the presence of the **cell membrane**. (…………………………)
- Insects have a hard, shell-like support called **an endoskeleton**. (……………………………)
- Cytoplasm is a **solid** matter that surrounds the cell's organelles. (……………………)
- The endoplasmic reticulum helps in the assembly and transport of **fats** in the cell. (………………………)
- **The endoplasmic reticulum** is the post office that packages proteins in the cell. (…………………………………)

Cross out the odd word:

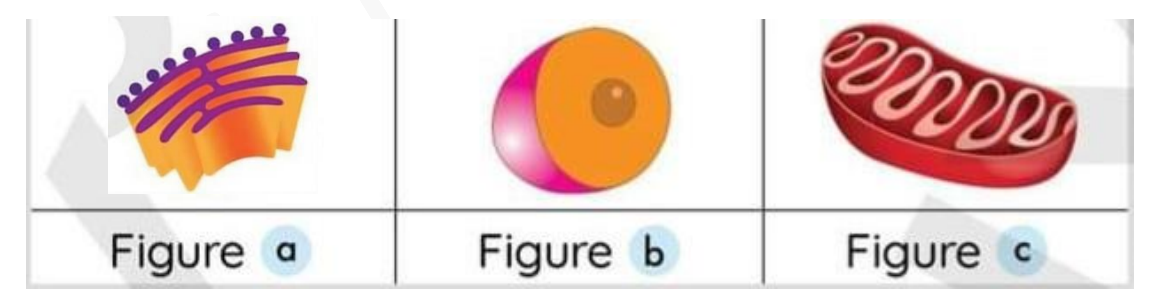
- Nucleus - Endoplasmic reticulum - Mitochondria - Chloroplasts
- Horses - Plants - Dogs – Insects

Choose from column (A) what suits it in column (B):

Column (A)	Column (B)
1. Mitochondrion 2. Golgi apparatus 3. Chloroplast 4. Vacuole 5. Endoplasmic reticulum 6. Nucleus	a) is the packaging factory for the cell. b) is the food factory of the cell. c) resembles the construction worker of a city. d) is the powerhouse of the cell. e) is considered the storage facility of the cell. f) resembles the city hall that controls all the cell activities.

Answer the following questions:

Study the following three figures, then answer:



- Figure (   ) converts sugar into energy.
- Figure (   ) is considered the protein maker in the cell.
- Figure (   ) helps in assembling and transporting proteins.

The following diagrams represent the

…………………….. and …………………………

Write the following labels:

a) …………………………………..

b) …………………………………..

c) …………………………………..

d) …………………………………..

e) …………………………………..

Mention the function of parts b and d.

………………………………………………………………………………………

………………………………………………………………………………………..

Give reasons for:

- Both plant and animal cells have common organelles.

……………………………………………………………………………………….

……………………………………………………………………………………….

- Animals can't make their own food.

……………………………………………………………………………………….

………………………………………………………………………………………

- Nucleus is the command center of the cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The animal cell has an indefinite shape, but the plant cell has a definite shape.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Animals can keep their shapes.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The vacuole of the plant cell is larger than that of the animal cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Mitochondria are considered the powerhouse of the cell.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The Golgi apparatus resembles the post office of a city.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The chloroplasts are the food factories of the cell.

………………………………………………………………………………………………

………………………………………………………………………………………………

- Endoplasmic reticulum has an important role in the cell.

………………………………………………………………………………………………

………………………………………………………………………………………………

<u>What happens if:</u>

1- Chloroplasts in a plant cell are damaged or functioning improperly.

………………………………………………………………………………………………

………………………………………………………………………………………………

2- Mitochondria stopped converting sugar into energy.

………………………………………………………………………………………………

………………………………………………………………………………………………

3- The endoplasmic reticulum is absent from the cell.

………………………………………………………………………………………………

………………………………………………………………………………………………

4- The Golgi apparatus is absent from the cell.

………………………………………………………………………………………………

………………………………………………………………………………………………

5- The plant has a small vacuole.

………………………………………………………………………………………………

………………………………………………………………………………………………

Lesson 5 & 6

Choose the correct answer:

1. Cell biologists use microscopes to magnify ………………… to appear larger.
   a. stones b. bricks c. cells d. rocks

2. Cell biologists do experiments and analyze data to study all the following, except …………………..
   a. how cells respond to different medicines.
   b. how rocks are formed on Earth's surface.
   c. how cells can work to repair body parts.
   d. how plant cells respond to different environmental factors.

3. To see the structure of a cell under microscope we must color it by using …………………..
   a. stains b. water c. sunlight d. vinegar

4. Methylene blue dye helps us to see the …………………… of the cell as a blue area under microscope.
   a. cytoplasm c. chloroplast
   b. Golgi apparatus d. nucleus

5. The 3D microscope can help in all the following, except that it helps ……..
    a. cell biologists learning more about cell components.
    b. scientists to know how planets revolve around the sun.
    c. doctors to treat some diseases as cancer.
    d. cell biologists learning more about how cells divide.

Put (√) or (x):

1) Cells are very large, as the diameter of an animal cell is about 0.001 cm. (   )
2) Cell biologists are scientists who study rocks. (   )
3) Cell biologists work in laboratories and do experiments to study how cells work inside living organisms. (   )
4) Cells are usually clear and colorless, so it is easy to see their structures under microscope. (   )
5) The 3D microscope can help doctors to treat cancer disease. (   )

Write the scientific term of each of the following:

1- They are scientists who study cells. (……………………………………)

2- A stain that is used to color the nucleus of the cell in blue color. (……………………………………..)

3- The microscope that helps us to see the top, sides and layers of the cell. (…………………………………….)

Complete the following sentences using the words below:

(methylene blue - microscope – agriculture - cell biologists - doctors)

A) Cell biologists use ……………………….. to magnify cells of bacteria.

B) Cell biologists work in …………………………… to study plant cells and their respond different environmental factors.

C) Cell biologists work with …………………………. to watch how cells can work to repair the human body parts.

D) To see the nucleus of a cell under microscope, we can stain the cell with ……………………………….

E) The 3D microscope can help …………………………. learn more about how cells divide.

Give reasons for:

- Some cell biologists work with doctors.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

- We must stain cells before examining them under microscope.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

What happens if…

We stain a sample of cheek cells with methylene blue dye.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Look at the opposite picture, then complete the following sentences:

1. These cells are seem large, because they are magnified by using ……………………
2. The structure of the cell which appears clearly with blue color in the opposite picture is the …………………

Cheek cells

3. These cells are stained by ………………………….. dye.

Look at the opposite picture, then answer the following questions: (A) Put (√) or (x):

1. This device helps doctors to treat some diseases such as cancer. ( )
2. This device doesn't need a computer to do its functions. ( )
3. This device helps cell biologists to see the cells in 3D. ( )



3D microscope

<u>(B) Rearrange the following sentences in the right order to show how this device works:</u>

- A computer puts these layers together. (   )
- Colors are added to the formed image. (   )
- It takes pictures of a cell in layers. (   )

Unit 1 – concept 1 – answers

Lesson 1

Choose the correct answer:

1) The ……………… is the building unit of a living organism's body.
   a. brick   **b. cell**   c. organ   d. blood

2) Humans are ………………. organisms.
   a. unicellular   **c. multicellular**
   b. prokaryote   d. simple

3) An unaided human eye can see an object ……….. millimeters long.
   a. 0.01   b. 0.005   **c. 0.5**   d. 0.001

4) An unaided human eye can't see all the following, except …………………..
   a. an onion's cell   c. a bacterial cell
   b. a skin's cell   **d. a bird's unfertilized egg cell**

5) A living organism grows and reproduces by increasing the ……………. of its body cells.
   a. number   b. size   c. volume   d. length

6) All the following are multicellular living organisms, except ……………..
   a. a bean plant   b. a cat   **c. bacteria**   d. a human

7) All the following are from the basic needs for the cell, except …………….
   a. Water   b. oxygen   c. food   **d. carbon dioxide**

8) The ……………… regulates the substances that pass in or out of the cell.
   a. Nucleus
   b. plasma membrane
   c. cell wall
   d. cytoplasm

9) Which statement about the cells is false?
   a. All living organisms are composed of cells.
   b. All cells come from existing cells.
   c. Most cells are microscopic in size.
   d. All cells have a nucleus.

Put (√) or (X):

1- Most cells are usually very small. (√)
2- The unaided human eye can see a bacteria cell. (X)
3- Different living organisms have similar cells that have similar functions. (X)
4- Increasing the number of the living organism's cells occurs during reproduction process only. (√)
5- The cell membrane allows water to enter the cell, but not to leave it. (X)
6- There must be a water imbalance at the two sides of the cell membrane, so that the cell won't burst. (X)
7- The cell membrane allows only the needed substances to enter the cell. (√)
8- Scientists can use a telescope to see the very small cells. (X)
9- An unfertilized bird egg contains more than one egg cell. (X)
10- Multicellular organisms consist of only one single cell, such as the plant cell. (X)

Write the scientific term:

1. They are the building units of life on Earth. (**cells**)
2. They are living organisms, and their bodies consist of more than one cell. (**multicellular organisms**)
3. They are living organisms, and their bodies consist of only one cell. (**unicellular organisms**)
4. It's a device used to see very small cells as a plant cell. (**microscope**)
5. It controls the substances that enter or leave the cell. (**cell membrane**)
6. It's a gas which the cell needs to get energy and perform its vital activities. (**oxygen gas**)
7. They're materials released from the cell. (**waste products**)
8. It's a liquid material that is necessary for the cell to do its function well. (**water**)

Complete the following sentences using the words between the brackets:

(**nucleus - shape – oxygen - energy - cell membrane – size – waste products – food**)

1) Cells in our body are different in **size** and **shape** because they have different functions.
2) All cells are composed of a **cell membrane**.
3) A cell takes in **oxygen** and **food** to get **energy** but it releases **waste products**.
4) Not all cells contain **nucleus**.

Correct the underlined words:

1- Most cells are very **large**, so we can see them with our naked eyes. (**small**)
2- A cell is a **simple** structure that carries out its vital activities. (**complex**)

3- Bacteria are **multicellular** living organisms.

(**unicellular**)

4- Living organisms can be divided into multicellular and unicellular organisms according to the **size** of cells in their bodies. (**number**)

5- The cell will **shrink** when too much water keeps entering it.

(**swell**)

Cross out the odd word:

a) Plant - **Bacteria** - Animal - Human

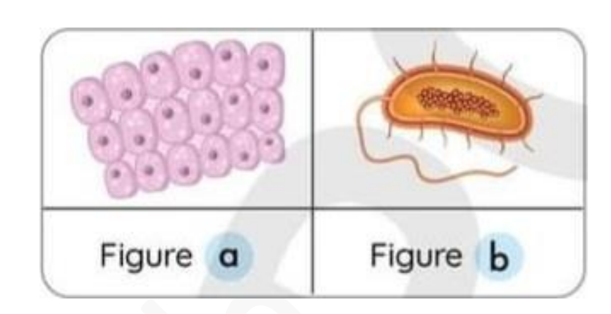
b) A skin cell - A plant cell - An animal's cell - **A bird's unfertilized egg cell**

c) Oxygen - Water - **Carbon dioxide** - Food

Choose from column (A) what suits it in column (B):

Column (A)		Column (B)
1. A cell membrane	c	a. is smaller than 0.005 mm long.
2. A bird's unfertilized egg cell	d	b. length ranges between 0.005 to 0.1 mm.
3. Bacterium	a	c. controls the amount of water that enters the cell.
4. A skin cell	b	d. is a very large cell.

Study the following figures, then complete the sentences below:



1) Figure **b** represents a bacterial cell, as it consists of **only one** cell(s).
2) Figure **a** represents the cells of a human skin.

Give reasons for:

1. The cell provides the structure of the living organism's body.
   - Because it's the building blocks of living organisms.

2. A plant is considered a multicellular organism.
   - Because they are organisms that have more than one cell.

3. Bacteria are considered unicellular organisms.
   - Because they are organisms made up of only one cell.

4. You can see a bird's unfertilized egg, but you can't see your skin cell without a microscope.
   - Because the unfertilized bird egg contains only one egg cell and it's very large, but the skin cell is very small and we need microscope to see it.

5. The cell membrane is very important for the cell.
   - Because it regulates which substances can enter or leave the cell.

6. The cells of the same living organisms are different in shape and size.
    - Because they have different functions.

7. The amount of water must be balanced at the two sides of the cell membrane.
    - Because if too much water enters the cell, the cell will swell until it bursts.

What happens if:

1- The cell can't get its basic needs.
- The cell will not get energy and grow so it will die.

2- The cell membrane is absent in an animal cell.
- There will be imbalance in leaving or entering the substances.

3- Too much water enters the cell.
- The cell will swell until it bursts.

Lesson 2

Choose the correct answer:

1) …………………… was the first scientist to use the word "cell".

a. Newton b. Hooke c. Edison d. Einstein

2) The nucleus was discovered during an observation of an enormous ……………….. cell.

a. animal b. bacterial c. human d. plant

3) Scientists concluded that the ………………. is the basic unit of the organism's structure.

a. cell b. organ c. tissue d. system

4) All the following are form the parts of a compound microscope, except the ……………….
   a. eyepiece
   b. objective lenses
   c. illuminator
   d. objective mirrors

5) The membrane of an onion consists of similar units called …………………
   a. cells
   b. nuclei
   c. organs
   d. tissues

6) You can change the power of magnifying of a microscope by using another …………………..
   a. objective lens
   b. eyepiece
   c. mirror
   d. arm

Put (√) or (X):

1. Developed microscopes have allowed scientists to make new discoveries. (√)
2. Sometimes a single cell exists on its own as in bacteria. (√)
3. The membrane of an onion consists of different units called cells. (√)
4. The cell in an onion membrane contains many components. (√)
5. A leaf cell and a red blood cell can exist in the same organism. (X)
6. Scientists must be open to new ideas about how cells work. (√)

Write the scientific term:

1- It's a device that can be used to magnify cells. (**microscope**)

2- They're the identical building units of living organisms.
(**cells**)

3- It's the type of water added on the samples in microscopes.
(**distilled water**)

4- It's a part of the microscope through which you look at the sample. (**eyepiece**)

5- It's a part of the microscope that changes the magnifying power. (**objective lens**)

Correct the underlined words:

I. A complex living system contains **one cell**.
(**more than one cell**)

II. We use drops of **tap** water on the sample in a microscope. (**distilled**)

III. We look at the sample through the **objective lens** of the microscope. (**eyepiece**)

IV. We change the magnifying power of the microscope by using a different **mirror**. (**objective lens**)

Cross out the odd word:

- Objective lens - Stage clips - Eyepiece - **Distilled water**
- A leaf cell - A red blood cell - A skin cell - **A bird's unfertilized egg cell**

Choose from column (A) what suits it in column (B):

Column (A)		Column (B)
1) The cell	b	a) changes the magnifying power of the microscope.
2) A compound microscope	c	b) is the building unit of the living organism's structure.
3) Changing the objective lens	a	c) can be used to examine a thin membrane of an onion.

Answer the following questions:

Study the following three figures that represent the samples under a compound microscope, then put true or false:

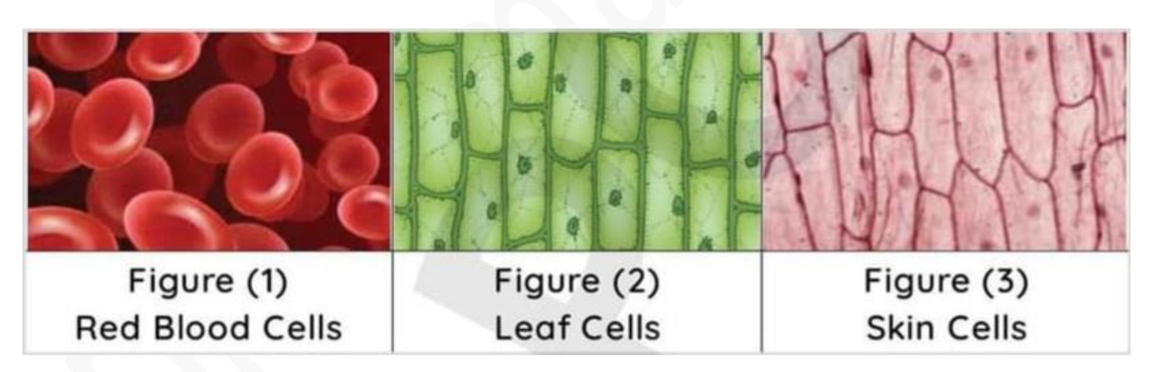
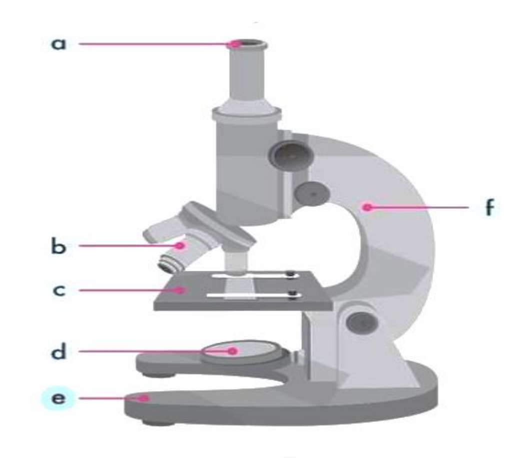


Figure (1) Red Blood Cells | Figure (2) Leaf Cells | Figure (3) Skin Cells

1. All the three samples represent microscopic cells. (√)
2. The three samples have different functions. (√)
3. All the three samples can exist in the same organism. (X)
4. Each figure represents the basic units that form an organism. (√)

The following diagram represents the structure of compound microscope.

Write the following labels:



- **a)** Eyepiece
- **b)** Objective lenses
- **c)** Stage
- **d)** illuminator
- **e)** Base

Give a reason for:

The microscope is very important for the biologists and botanists.

- To be able to look at small things in more details.

What happens if:

The microscope wasn't invented.

- Scientists would not be able to discover the cell and its structure.

Lesson 3

Choose the correct answer:

1) The human body is composed of ……………… cells.
   a. 40 hundred b. 40 thousand c. 40 million d. 40 trillion

2) All the following are from the cells found in the animal body, except the ………………….
   a. blood cells c. bone cells
   b. xylem cells d. muscle cells

3) A/An ………………… is a unicellular simple living organism.
   a. human b. animal c. bacterium d. plant

4) The tissue is a set of similar ……………………
   a. systems   b. cells   c. organs   d. organelles

5) All the following are considered organs, except the ………………..
   a. lung   b. heart   c. stomach   d. muscle tissue

6) The systems that keep a multicellular organism alive are divided into …………….. levels.
   a. two   b. three   c. four   d. five

7) All the following organelles are common in plants and animals cells, except the ………………..
   a. cytoplasm   c. nucleus
   b. cell wall   d. cell membrane

8) Cell's components are suspended in the …………………..
   a. Nucleus   c. cytoplasm
   b. cell wall   d. cell membrane

9) The ……………… surrounds the plant cell from outside and gives it a definite shape.
   a. Nucleus   c. cytoplasm
   b. cell wall   d. cell membrane

10) The ……………. is a liquid that fills the cavity of the cell and is surrounded by the cell membrane.
   a. Nucleus   c. cytoplasm
   b. cell wall   d. mitochondrion

11) The ……………. surrounds the cytoplasm and controls the substances that enter or leave the cell.
   a. cell wall   c. plasma membrane

b. nucleus d. mitochondrion

Put (√) or (x):

1- The number of cells in plants and animals varies from a species to another. (**√**)
2- A stomach consists of a group of tissues. (**√**)
3- The liver is a tissue, while the heart is an organ. (**X**)
4- The respiratory system consists of a set of cells. (**X**)
5- The cell is the smallest building unit of a living organism. (**√**)
6- Both the mitochondrion and plasma membrane are found in plant and animal cells. (**√**)
7- The cell membrane surrounds the plant cell from outside. (**√**)
8- Nucleus, mitochondria and cell membrane float in the cytoplasm. (**X**)
9- The outermost layer of the cell is called "cell membrane". (**√**)

Write the scientific term:

1. It is a structure inside the cell that has a specific function. (**organelle**)
2. It is a set of tissues forming a structural unit to perform a specific function. (**organ**)
3. It is a group of identical cells that perform the same function. (**tissue**)
4. It is a group of organs that perform a specific function. (**system**)
5. It's a liquid in which the cell's organelles float. (**cytoplasm**)
6. It's a feature through which the cell membrane determines which substances will pass through. (**selective permeability**)

7. It's the outer lining of the cell that surrounds the cytoplasm. (**cell membrane**)
8. It's the structure that controls the cell activities. (**nucleus**)
9. They are the powerhouses of energy in the cell. (**mitochondria**)
10. It's a process of using oxygen to get chemical energy from food in the cell. (**cellular respiration**)

Complete the following sentences using the words between the brackets:

(cells - similar - nucleus - organelles – tissues)

1) A cell consists of **organelles** that are functioning in **similar** ways to maintain the cell.
2) An organ is composed of a set of **tissues** that are composed of a group of **cells**.
3) The **nucleus** in the cell is responsible for cell division.

Correct the underlined words:

A) A system is composed of a set of **tissues** that work together. (**organs**)
B) The stomach and lung are considered **systems**. (**organs**)
C) The liver consists of a group of **organelles**. (**tissues**)
D) The **cytoplasm** is the control center of the cell. (**nucleus**)
E) The **cell wall** is a semi-permeable membrane that controls the substances entering the cell. (**cell membrane**)
F) **Photosynthesis process** takes place inside the mitochondria. (**cellular respiration**)

G) The **plant** cell is the building unit of the human body.

(**animal**)

Cross out the odd word:

- Cell membrane - **Cell wall** - Nucleus – Cytoplasm
- Digestive system - Respiratory system - Circulatory system - **Heart**
- **Blood cell** - Stomach - Lung - Liver

Choose from column (A) what suits it in column (B):

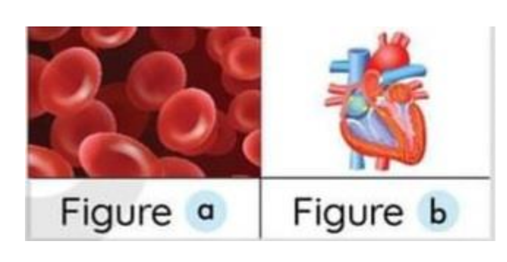
Column (A)		Column (B)
1- Nucleus	**a**	a- is the control center of the cell.
2- Cell membrane	**c**	b- supports the plant cell from outside.
3- Cell wall	**b**	c- controls the substances passing into or out of the cell.

Answer the following questions:

Study the following three figures, then answer:

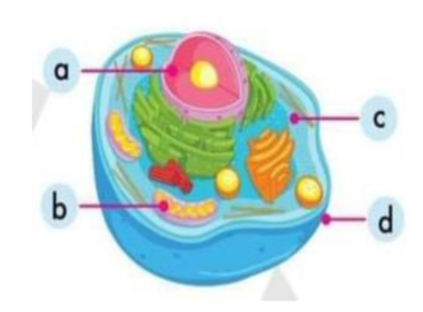
A) Figure (**b**) consists of tissues.

B) Figure (**a**) represents a group of cells.



The following diagram represents the structure of animal cell.

Write the following labels:



a) Nucleus
b) Mitochondria
c) Cytoplasm
d) Cell membrane

Give reasons for:

❖ All organs of the digestive system work together.
- Because each organ performs a specific function to form the digestive system.

❖ The cell membrane has the selective permeability property.
- Because some substances can pass through it, while others can't.

❖ The nucleus has an important role for the cell.
- Because it's responsible for controlling cell activities such as making proteins and cell division.

❖ The mitochondrion has an important role for the cell.
- Because they are powerhouses that supply the cell with energy, and cellular respiration takes place in it.

What happens if:

1) The cell wall in the plant cell is absent.
   - The plant cell will have indefinite shape.
2) The mitochondria are absent from an animal cell.
   - The cell will not supply with energy and cellular respiration doesn't take place.

Lesson 4

Choose the correct answer:

1. Which of the following is found in both plant and animal cells?
   a. Cell membrane c. Large, water-filled vacuole
   b. Cell wall d. Chloroplast

2. Which two organelles are involved in transportation?
   a. Nucleus and endoplasmic reticulum
   b. Mitochondria and nucleus
   c. Chloroplast and Golgi apparatus
   d. Endoplasmic reticulum and Golgi apparatus

3. Photosynthesis process takes place in the ………………… while cellular respiration takes place in the ……………….
   a. nucleus – cytoplasm c. mitochondria – chloroplast
   b. mitochondria – nucleus d. chloroplast - mitochondria

4. …………………… are unique structures that exist only in the plant cell.
   a. Mitochondria b. Nuclei c. Vacuoles d. Chloroplasts

5. The plant cell is distinguished from the animal cell by the presence of ………………… and ……………………
   a. chloroplasts - nucleus c. chloroplasts - cell wall
   b. nucleus - cell wall d. nucleus - cytoplasm

6. The ………………… release(s) energy to power the cell.
   a. Mitochondria c. nucleus
   b. cell wall d. cell membrane

7. ………………… is the command center of the cell.

a. Chloroplast
b. Mitochondrion
c. Nucleus
d. Cell membrane

8. All the following can be stored in the cell vacuole, except ....
   a. waste
   b. cytoplasm
   c. water
   d. nutrients

9. The .... transports proteins in the cell.
   a. Golgi apparatus
   b. Mitochondrion
   c. endoplasmic reticulum
   d. nucleus

10. The .... controls the substances that enter or leave the cell.
   a. cytoplasm
   b. cell wall
   c. nucleus
   d. cell membrane

11. The envelopes of the cell used for transporting materials are the ....
   a. nuclei
   b. chloroplasts
   c. mitochondria
   d. Golgi bodies

12. The .... in the cell resembles the powerful brick wall of a city.
   a. Nucleus
   b. cell wall
   c. cytoplasm
   d. cell membrane

13. Golgi apparatus can .... inside the cell.
   a. transport protein
   b. package waste
   c. makes proteins
   d. a and b

Put (√) or (x):

1- Both plant and animal cells have common organelles to organize and maintain the cell. (√)

2- Chloroplasts release energy from the food, but mitochondria produce energy from the sunlight. (**X**)

3- Chloroplasts have yellow grains called chlorophyll pigment. (**X**)

4- The outermost layer of a plant cell is the cell wall, but the outermost layer in an animal cell is the cell membrane. (**√**)

5- The animal cell has a definite shape, while the plant cell has an indefinite shape. (**X**)

6- Golgi apparatus can transport materials inside cells, but it can't transport them outside them. (**X**)

7- The plant cell has a larger vacuole than that of the animal cell. (**√**)

8- The cell membrane looks like guards at the gates of a city. (**√**)

<u>Write the scientific term:</u>

1) They help plant and animal cells control, organize, and maintain the cell. (**Organelles**)
2) It controls the functions inside the cell and cell division. (**Nucleus**)
3) They are saclike organelles that store nutrients, water, and waste. (**Vacuole**)
4) It's the fluid found in the cell that holds its organelles. (**Cytoplasm**)
5) They're organelles in the plant cell that convert light energy into sugar. (**Chloroplast**)
6) They're organelles in the plant cell that power the cell with energy. (**Mitochondria**)
7) It's a process that occurs inside the chloroplast. (**Photosynthesis process**)
8) It's a process that occurs inside the mitochondria. (**Cellular respiration**)

Complete the following sentences using the words between the brackets:

(Golgi apparatus - sugar - Mitochondria – chloroplasts – exoskeleton - chlorophyll - Bones - endoplasmic reticulum)

- **Bones** support(s) the fish body shape, while a/an **exoskeleton** supports that of insects.
- In the photosynthesis process, **chlorophyll** absorb(s) sunlight, where **chloroplasts** use(s) it to make the plant's food.
- **Endoplasmic reticulum** transport(s) proteins produced by the **Golgi apparatus** through the cell.
- **Mitochondria** convert(s) **sugar** into energy that is needed for the cell activities.

Correct the underlined words:

- Chloroplasts have a green color due to the presence of **iodine** pigment. (**chlorophyll**)
- A plant cell has a rigid shape due to the presence of the **cell membrane**. (**cell wall**)
- Insects have a hard, shell-like support called **an endoskeleton**. (**exoskeleton**)
- Cytoplasm is a **solid** matter that surrounds the cell's organelles. (**liquid**)
- The endoplasmic reticulum helps in the assembly and transport of **fats** in the cell. (**proteins**)
- **The endoplasmic reticulum** is the post office that packages proteins in the cell. (**Golgi apparatus**)

Cross out the odd word:

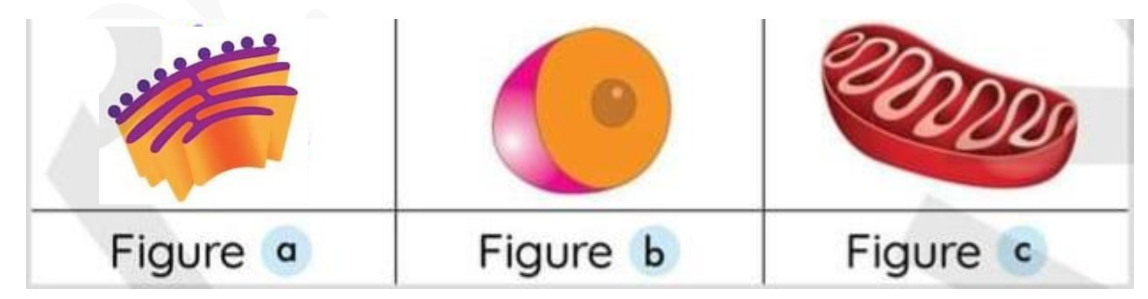
- Nucleus - Endoplasmic reticulum - Mitochondria - **Chloroplasts**
- Horses - **Plants** - Dogs – Insects

Choose from column (A) what suits it in column (B):

Column (A)		Column (B)
1. Mitochondrion	d	a) is the packaging factory for the cell.
2. Golgi apparatus	a	b) is the food factory of the cell.
3. Chloroplast	b	c) resembles the construction worker of a city.
4. Vacuole	e	d) is the powerhouse of the cell.
5. Endoplasmic reticulum	c	e) is considered the storage facility of the cell.
6. Nucleus	f	f) resembles the city hall that controls all the cell activities.

Answer the following questions:

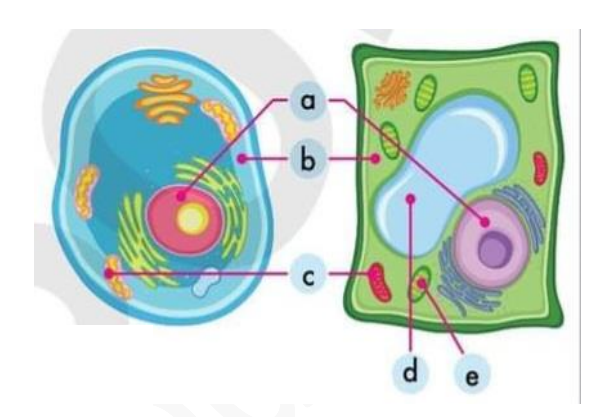
Study the following three figures, then answer:



- Figure (c) converts sugar into energy.
- Figure (b) is considered the protein maker in the cell.
- Figure (a) helps in assembling and transporting proteins.

The following diagrams represent the structure of plant cell and animal cell

Write the following labels:



a) Nucleus
b) Cytoplasm
c) Mitochondria
d) Vacuole
e) Chloroplasts

***Mention the function of parts b and d*.**

Part b (cytoplasm): it's the gelatinous liquid inside the cells in which other cell parts float.
Part d (Vacuole): it is used for the storage of nutrients, water and waste.

Give reasons for:

- Both plant and animal cells have common organelles.
  - Because both of them have cell membrane, cytoplasm, nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, and vacuole.

- Animals can't make their own food.
  - Because they don't have chloroplasts.

- Nucleus is the command center of the cell.
  - Because it controls the functions inside the cell such as: making proteins and cell division.

- The animal cell has an indefinite shape, but the plant cell has a definite shape.
    - Because the animal cell doesn't have cell wall, but the plant cell has rigid cell wall.

- Animals can keep their shapes.
    - Because some animals have bones, and insects have an exoskeleton.

- The vacuole of the plant cell is larger than that of the animal cell.
    - Because the plant stores a large amount of water in the vacuole.

- Mitochondria are considered the powerhouse of the cell.
    - Because it converts sugar into energy for the cell.

- The Golgi apparatus resembles the post office of a city.
    - Because it helps package nutrients within vital products inside the cell and it helps transport nutrients outside the cell.

- The chloroplasts are the food factories of the cell.
    - Because they contain chlorophyll and carry out the photosynthesis process.

- Endoplasmic reticulum has an important role in the cell.
    - Because it helps in assembling and transporting proteins.

What happens if:

1- Chloroplasts in a plant cell are damaged or functioning improperly.

- The plant will not be able to absorb energy from sunlight to make its own food.

2- Mitochondria stopped converting sugar into energy.

- The cell will not supply with energy and cellular respiration doesn't take place.

3- The endoplasmic reticulum is absent from the cell.

- The cell will not be able to assemble and transport proteins.

4- The Golgi apparatus is absent from the cell.

- The nutrients will not transport outside the cell, and they will not be packaged within vital products inside the cell.

5- The plant has a small vacuole.

- The plant will not be able to store a large amount of water, nutrients and wastes.

Lesson 5 & 6

Choose the correct answer:

1. Cell biologists use microscopes to magnify ………………… to appear larger.
   a. stones   b. bricks   c. cells   d. rocks

2. Cell biologists do experiments and analyze data to study all the following, except …………………..

a. how cells respond to different medicines.
b. how rocks are formed on Earth's surface.
c. how cells can work to repair body parts.
d. how plant cells respond to different environmental factors.

3. To see the structure of a cell under microscope we must color it by using ....
   a. stains b. water c. sunlight d. vinegar

4. Methylene blue dye helps us to see the .... of the cell as a blue area under microscope.
   a. cytoplasm c. chloroplast
   b. Golgi apparatus d. nucleus

5. The 3D microscope can help in all the following, except that it helps ....
   a. cell biologists learning more about cell components.
   b. scientists to know how planets revolve around the sun.
   c. doctors to treat some diseases as cancer.
   d. cell biologists learning more about how cells divide.

Put (√) or (x):

1) Cells are very large, as the diameter of an animal cell is about 0.001 cm. (X)
2) Cell biologists are scientists who study rocks. (X)
3) Cell biologists work in laboratories and do experiments to study how cells work inside living organisms. (√)
4) Cells are usually clear and colorless, so it is easy to see their structures under microscope. (X)
5) The 3D microscope can help doctors to treat cancer disease. (√)

Write the scientific term of each of the following:

1- They are scientists who study cells. (**cell biologists**)
2- A stain that is used to color the nucleus of the cell in blue color. (**methylene blue**)
3- The microscope that helps us to see the top, sides and layers of the cell. (**3D microscope**)

Complete the following sentences using the words below:

(methylene blue - microscope – agriculture - cell biologists - doctors)

A) Cell biologists use **microscope** to magnify cells of bacteria.
B) Cell biologists work in **agriculture** to study plant cells and their respond different environmental factors.
C) Cell biologists work with **doctors** to watch how cells can work to repair the human body parts.
D) To see the nucleus of a cell under microscope, we can stain the cell with **methylene blue**.
E) The 3D microscope can help **cell biologists** learn more about how cells divide.

Give reasons for:

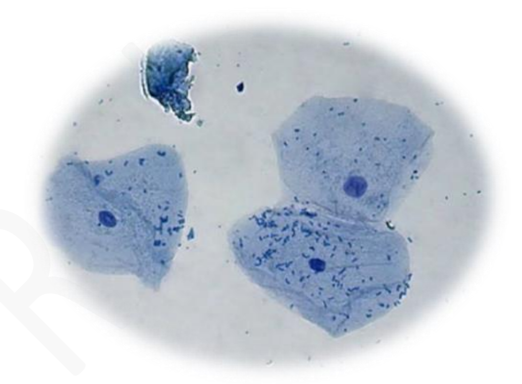
- Some cell biologists work with doctors.
  - **To watch how cells can work to repair the human body parts.**
- We must stain cells before examining them under microscope.
  - **Because the cells are usually clear and colorless and to make their structures more visible.**

What happens if…

We stain a sample of cheek cells with methylene blue dye.

- **We will see the nucleus as a blue area.**

Look at the opposite picture, then complete the following sentences:



Cheek cells

1. These cells are seem large, because they are magnified by using **microscope**.
2. The structure of the cell which appears clearly with blue color in the opposite picture is the **nucleus**.
3. These cells are stained by **methylene blue** dye.

Look at the opposite picture, then answer the following questions: (A) Put (√) or (x):



3D microscope

1. This device helps doctors to treat some diseases such as cancer. (**√**)
2. This device doesn't need a computer to do its functions. (**X**)
3. This device helps cell biologists to see the cells in 3D. (**√**)

(B) Rearrange the following sentences in the right order to show how this device works:

- A computer puts these layers together. (**2**)
- Colors are added to the formed image. (**3**)
- It takes pictures of a cell in layers. (**1**)

Unit 1 – Concept 2
{ The body as a system }





- In the opposite picture, the runners were nervous (or stressed).
- When you feel nervous, your heartbeats increase, your body starts to sweat and you may feel pain in your stomach.
- ***In your body, all systems work together as one whole body system.***

How does your body function as a system?

- Different systems in your body perform different functions, where all systems interact and work together in an integrated way.

<u>Examples:</u>

- The interaction between the nervous system and the circulatory system, where when you feel nervous, your heartbeats increase.

- The interaction between the digestive system and the skeletal system, where the digestive system provides the skeletal system with nutrients needed for growth and fracture healing.

- في الصورة المعاكسة، العدائين متوترين .
- عندما تشعر بالتوتر، تزداد نبضات قلبك، ويبدأ جسمك بالتعرق وقد تشعر بألم في معدتك.
- ***في جسمك، تعمل جميع الأجهزة معًا كجهاز واحد كامل للجسم.***

كيف يعمل جسمك كنظام؟

- تؤدي الأجهزة المختلفة في جسمك وظائف مختلفة، حيث تتفاعل جميع الأنظمة وتعمل معًا بطريقة متكاملة.

أمثلة:

- التفاعل بين الجهاز العصبي والجهاز الدوري، حيث عندما تشعر بالتوتر تزداد نبضات قلبك.
- التفاعل بين الجهاز الهضمي والجهاز الهيكلي، حيث يقوم الجهاز الهضمي بتزويد الجهاز الهيكلي بالعناصر الغذائية اللازمة للنمو وشفاء الكسور.

How do your body systems work together in dangerous situations?



- The opposite picture shows a cyclist in a dangerous situation.
- The body systems of the cyclist work together to produce physical responses such as an **increase in the heartbeats** to face this dangerous situation,
  - When the eyes of the cyclist see a dangerous situation, **the brain receives the information from the eyes**.
  - Then, **the brain sends a signal to the muscles that contract and allow his body to face the danger**.

So, ***the interactions between body systems (circulatory system and muscular system) are important in dangerous situations***.

كيف تعمل أجهزة الجسم معًا في المواقف الخطرة؟

- الصورة المقابلة تظهر راكب دراجة في وضع خطير.
- تعمل أجهزة الجسم لدى راكب الدراجة معًا لإنتاج استجابات جسدية مثل زيادة نبضات القلب لمواجهة هذا الوضع الخطير، حيث:
  - عندما ترى عيون راكب الدراجة موقفاً خطيراً، يستقبل الدماغ المعلومات من العينين.
  - ثم يرسل الدماغ إشارة إلى العضلات التي تنقبض وتسمح لجسمه بمواجهة الخطر.

لذا ***فإن التفاعلات بين أجهزة الجسم (الدورة الدموية والجهاز العضلي) مهمة في المواقف الخطرة.***

All systems interact and work together in an integrated way

Example shows how do the nervous system, circulatory system and digestive system depend on each other to do their functions.

The nerve cells in the **nervous system** need nutrients to perform their functions, these nutrients reach the body as food.



After the **digestive system** digests this food, nutrients are transmitted to the nerve cells through the blood in the **circulatory system**.

(This means that the nervous system depends on the digestive system and circulatory system to do its function).



Also, the **nervous system** controls the muscles of stomach in the **digestive system** and the muscles of heart in the **circulatory system**.

(This means that the digestive system and circulatory system depend on the nervous system to do their functions).

جميع الأنظمة تتفاعل وتعمل معًا بطريقة متكاملة.

المثال التالي يوضح كيف يعتمد الجهاز العصبي والجهاز الدوري والجهاز الهضمي على بعضهم البعض للقيام بوظائفهم:

- تحتاج الخلايا العصبية في الجهاز العصبي إلى العناصر الغذائية لتؤدي وظائفها، وتصل هذه العناصر الغذائية إلى الجسم على شكل غذاء.
- وبعد أن يهضم الجهاز الهضمي هذا الطعام، تنتقل العناصر الغذائية إلى الخلايا العصبية عبر الدم في الدورة الدموية.

(وهذا يعني أن الجهاز العصبي يعتمد على الجهاز الهضمي والدورة الدموية للقيام بوظيفته).

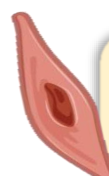
- كما يتحكم الجهاز العصبي في عضلات المعدة في الجهاز الهضمي وعضلات القلب في الدورة الدموية.

(وهذا يعني أن الجهاز الهضمي والدورة الدموية يعتمدان على الجهاز العصبي للقيام بوظائفهما).



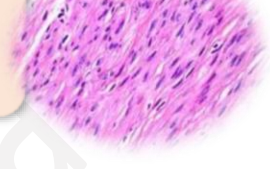
Building living systems

- The human body is a <u>**multicellular organism**</u> that consists of:



Different shapes of animal **cells**

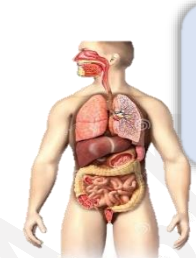
A group of similar cells form a **tissue**



A group of different systems form the **whole body**

A group of different tissues form an **organ**

A group of different organs form a **system**





How are cells organized to build the human body?

From cells to tissues

Although all cells have things in common but there are many shapes and sizes of cells because cells must be specialized to perform specific function.

<u>Example</u>: **Muscle cells**

- They are in the form of <u>**long fibers**</u> to allow movement.
- They must be able to store and use energy quickly.

- They do not work alone, because the size of the muscle cell is very small and must work with thousands of other cells to be effective.
- They are bundled (collected) together to form **tissues**.

جسم الإنسان هو كائن متعدد الخلايا يتكون من:

- أشكال مختلفة من الخلايا الحيوانية.
- تشكل مجموعة من الخلايا المتشابهة نسيجًا.
- تشكل مجموعة من الأعضاء المختلفة نظامًا.
- مجموعة من الأنسجة المختلفة تشكل عضوًا.
- مجموعة من الأجهزة المختلفة تشكل الجسم كله.

كيف يتم تنظيم الخلايا لبناء جسم الإنسان؟

من الخلايا إلى الأنسجة:

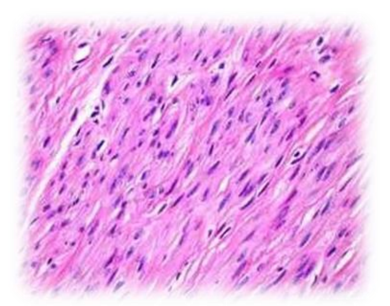
على الرغم من أن جميع الخلايا لديها أشياء مشتركة إلا أن هناك العديد من أشكال وأحجام الخلايا، لأن الخلايا يجب أن تكون متخصصة لأداء وظيفة محددة.

مثال: خلايا العضلات

- وهي على شكل **ألياف طويلة** لتسمح بالحركة.
- يجب أن يكونوا قادرين على تخزين واستخدام الطاقة بسرعة.
- إنهم لا يعملون بمفردهم، لأن حجم الخلية العضلية صغيرة جدًا ويجب أن تعمل مع آلاف الخلايا الأخرى لتكون فعالة.
- يتم تجميعها (جمعها) معًا لتكوين **الأنسجة**.

From tissues to organs

- Bundles of tissues are organized to form the **muscle**.
- The muscle is considered an **organ**.
- An organ is a part of an organism that has a specific function.



Muscle tissue
نسيج عضلة

Example: The muscle that lies on the front part of upper arm between the elbow and the shoulder.

من الأنسجة إلى الأعضاء:

- يتم تنظيم حزم من الأنسجة لتكوين <u>**العضلات**</u>.
- تعتبر العضلة <u>**عضوا**</u>.
- العضو هو جزء من كائن حي له وظيفة محددة.

<u>مثال</u>: العضلة التي تقع في الجزء الأمامي من أعلى الذراع بين المرفق والكتف.

From organs to systems

- There are many organs in the body.
- Each system is a group of organs that perform a specific function for the body.

<u>Example</u>: **Musculoskeletal system**

- The **musculoskeletal system** is formed of two systems which are **muscular system** and **skeletal system** that work together to allow the body movement.

- It consists of a group of organs which are :
  - **Bones**.
  - **Muscles**.
  - **Ligaments**.
  - **Tendons**.
  - **Cartilages**.

- Each of these organs has a specific role to allow the musculoskeletal system to do its function.

Muscular system

skeletal system

Musculoskeletal system

من الأعضاء إلى الأجهزة:

- هناك العديد من الأعضاء في الجسم.
- كل جهاز عبارة عن مجموعة من الأعضاء التي تؤدي وظيفة محددة للجسم

مثال: **الجهاز العضلي الهيكلي**

- يتكون الجهاز العضلي الهيكلي من نظامين هما الجهاز العضلي والجهاز الهيكلي اللذان يعملان معًا للسماح بحركة الجسم.
- يتكون من مجموعة من الأعضاء وهي :
  - **العظام.** - **العضلات.**
  - **الأربطة.** - **الأوتار.**
  - **الغضاريف.**
- ولكل من هذه الأعضاء دور محدد للسماح للجهاز العضلي الهيكلي بالقيام بوظيفته.

From systems to the whole body

- Many of the simple tasks you perform daily require different systems to work together.

Example:

- When you play football, this requires interaction between the respiratory system circulatory system, nervous system, musculoskeletal system and excretory system.

من الأجهزة إلى الجسم كله:

- العديد من المهام البسيطة التي تقوم بها يوميًا تتطلب أنظمة مختلفة للعمل معًا

مثال:

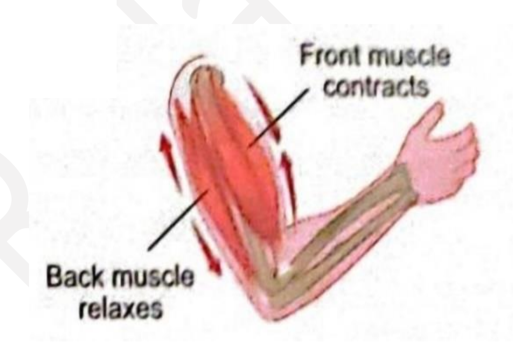
- عندما تلعب كرة القدم فإن ذلك يتطلب التفاعل بين الجهاز التنفسي والجهاز الدوري والجهاز العصبي والجهاز العضلي الهيكلي والجهاز الإخراجي.

Moving Muscles

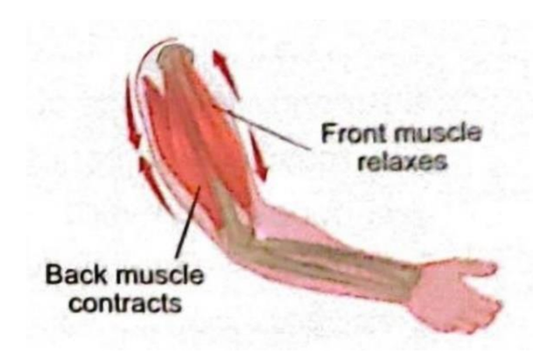
- An example of systems which are the skeletal system and muscular system that work together to allow the movement of your arm towards your shoulder.

- ***Your arm moves due to contraction and relaxation of muscles connected to the bones of the arm, where:***

The forearm moves up towards your shoulder when the muscle **in front of** the upper arm **contracts** and the muscle **in the back** of the upper arm **relaxes**.



The forearm moves down away from your shoulder when the muscle **in front of** the upper arm **relaxes** and the muscle **in the back** of the upper arm **contracts**.



- The skeletal muscles that are attached to the bones of skeletal system (such as the bones of fingers, legs, arms and other body parts) contract and relax to allow these bones to move.
- The muscle can only exert force when it contracts.
- The contraction of muscles moves the bones in one direction only.

- The skeletal muscles are often work in pairs and move in opposite directions as shown in the previous example.

العضلات المتحركة

- مثالاً على الأجهزة وهي الجهاز الهيكلي والجهاز العضلي اللذان يعملان معًا للسماح بحركة ذراعك نحو كتفك.
- تتحرك ذراعك بسبب انقباض واسترخاء العضلات المتصلة بعظام الذراع، حيث
  - يتحرك الساعد للأعلى باتجاه كتفك عندما **تنقبض** العضلة الموجودة **أمام** الجزء العلوي من الذراع **وتسترخي** العضلة الموجودة في الجزء **الخلفي** من الجزء العلوي من الذراع.
  - يتحرك الساعد للأسفل بعيدًا عن كتفك عندما **تسترخي** العضلة الموجودة **أمام** الجزء العلوي من الذراع **وتنقبض** العضلة الموجودة في الجزء **الخلفي** من الجزء العلوي من الذراع.

- تنقبض العضلات الهيكلية المرتبطة بعظام الجهاز الهيكلي (مثل عظام الأصابع والساقين والذراعين وأجزاء الجسم الأخرى) وترتخي لتسمح لهذه العظام بالحركة.
- لا تستطيع العضلة بذل القوة إلا عندما تنقبض.
- إن انقباض العضلات يحرك العظام في اتجاه واحد فقط.
- غالباً ما تعمل العضلات الهيكلية في أزواج وتتحرك في اتجاهين متعاكسين كما هو موضح في المثال السابق.



Mighty Muscles

Types of muscles

Voluntary muscles

They are muscles that you can control their movement.

Examples:

- Skeletal muscles such as:
    1. Upper arm muscles.
    2. Neck muscles.
    3. Forearm muscles.
- Abdomen muscles.

Involuntary muscles

They are muscles that move automatically, and you cannot control their movement.

Examples:

- Cardiac muscle.
- Eye muscles.

العضلات الإرادية

إنها عضلات يمكنك التحكم في حركتها.

أمثلة:

- العضلات الهيكلية مثل:
    1. عضلات الذراع العليا.
    2. عضلات الرقبة.
    3. عضلات الساعد.
- عضلات البطن.

العضلات اللا إرادية

وهي عضلات تتحرك بشكل تلقائي ولا يمكنك التحكم في حركتها.

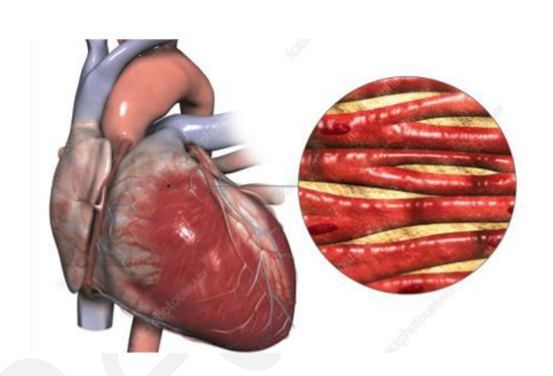
أمثلة:

- عضلة القلب.
- عضلات العين.

Examples of involuntary and voluntary muscles:

Cardiac muscle

- The **heart** is made of a type of involuntary muscles known as ***cardiac muscle***.
- Cardiac muscle contracts and relaxes **without stopping** to allow the heart pumps the blood carrying oxygen to all the body cells.



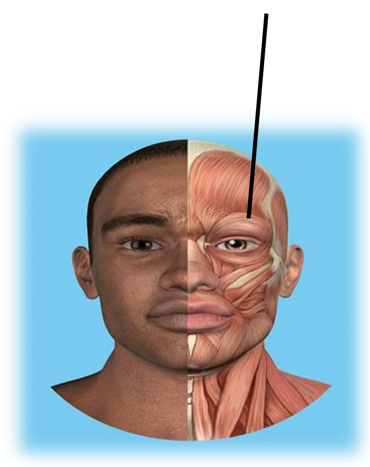
أمثلة على العضلات اللاإرادية والإرادية:

عضلة القلب

- يتكون القلب من نوع من **العضلات اللاإرادية** المعروفة باسم ***عضلة القلب***.
- تنقبض عضلة القلب وتسترخي **دون توقف** ليتمكن القلب من ضخ الدم الذي يحمل الأكسجين إلى جميع خلايا الجسم.

Eye muscles

- Your **eyes** contain a type of **involuntary muscles** that contract w**hen you close your eyelid** to allow you blink many times in one minute without thinking.
- Your eyes also contain voluntary muscles that surround the eyeball to help **you move your eyes in different directions**.

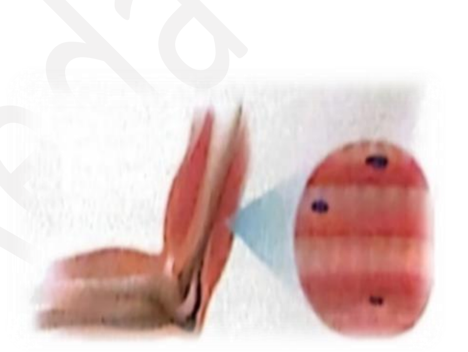


عضلات العين

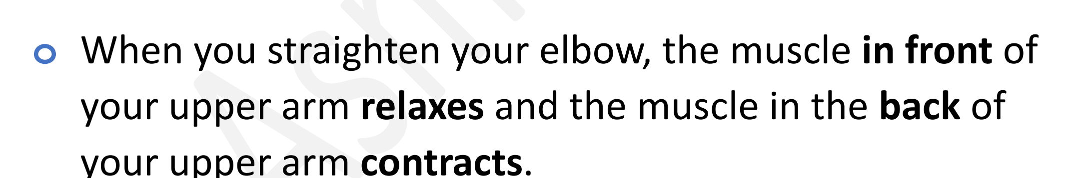
- تحتوي عيناك على نوع من **العضلات اللاإرادية** التي تنقبض **عند إغلاق جفنك** لتسمح لك بالرمش عدة مرات في الدقيقة الواحدة دون تفكير.
- تحتوي عيناك أيضًا على عضلات إرادية تحيط بمقلة العين لتساعدك على **تحريك عينيك في اتجاهات مختلفة**.

Skeletal muscles

1) Upper arm muscles:



- Bending your elbow depends on two different **voluntary muscles**, where:
  - When you bend your elbow, the muscle **in front** of your upper arm **contracts** and the muscle in the **back** of your upper arm **relaxes**.
  - When you straighten your elbow, the muscle **in front** of your upper arm **relaxes** and the muscle in the **back** of your upper arm **contracts**.



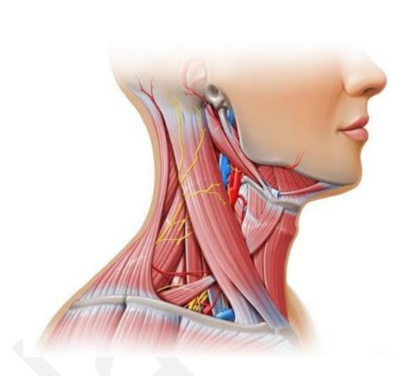
العضلات الهيكلية

عضلات الذراع العلوية:

- يعتمد ثني مرفقك على **عضلتين إراديتين** مختلفتين، حيث:
  - عندما تقوم بثني مرفقك، **تنقبض** العضلة الموجودة **أمام** الجزء العلوي من ذراعك **وتسترخي** العضلة الموجودة في الجزء **الخلفي** من ذراعك العلوي.
  - عندما تقوم بفرد مرفقك، **تسترخي** العضلة الموجودة **أمام** الجزء العلوي من ذراعك: **وتنقبض** العضلة الموجودة في الجزء **الخلفي** من ذراعك العلوي.

2) Neck muscles:

- Moving your head up and down depends on two important **neck voluntary muscles**, where:
  - When you move your head up, one of these muscles contracts.
  - When you move your head down, the other muscle contracts.



عضلات الرقبة:

- تحريك رأسك للأعلى والأسفل يعتمد على اثنين من **عضلات الرقبة الهامة الإرادية**، حيث:
  - عند تحريك رأسك للأعلى، تنقبض إحدى هذه العضلات.
  - عندما تحرك رأسك إلى الأسفل، تنقبض العضلة الأخرى.

3) Forearm muscles:

- Turning your hand depends on two important **forearm voluntary muscles**, where:
  - When you turn your hand over (your palm up), one of these muscles contracts.
  - When you turn your hand down (your palm down), the other muscle contracts.



عضلات الساعد:

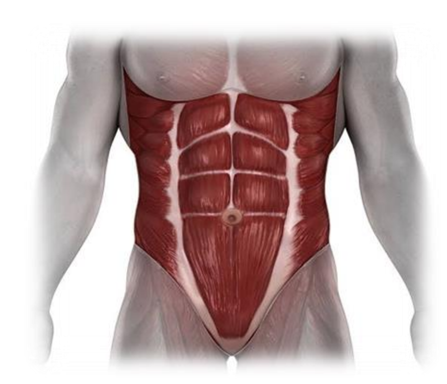
- يعتمد تدوير يدك على **عضلتين إرادتين مهمتين في الساعد**، حيث:
  - عندما تقلب يدك (راحة يدك للأعلى)، تنقبض إحدى هذه العضلات
  - عندما تقوم بتحريك يدك للأسفل (راحة اليد للأسفل)، تنقبض العضلة الأخرى.

- When a pair of skeletal muscles perform an action, **one muscle contracts**, while **the other muscle relaxes**.
- All muscles work by contraction.

- عندما يقوم زوج من العضلات الهيكلية بعمل ما، تنقبض إحدى العضلة، بينما تسترخي العضلة الأخرى.
- جميع العضلات تعمل بالانقباض.

Abdomen muscles

- You have two important **abdomen voluntary muscles** on each side of your body known as ***waist muscles***.
- ***When you twist your waist to one side, the two muscles on that side contract together, while the two muscles on the other side relax.***



عضلات البطن

- لديك **عضلتان إراديتان مهمتان في البطن** على كل جانب من جسمك تعرفان ***بعضلات الخصر***.
- ***عندما تقوم بتحريف خصرك إلى أحد الجانبين، تنقبض العضلتان الموجودتان على هذا الجانب معًا، بينما تسترخي العضلتان الموجودتان على الجانب الآخر.***

Systems Work Together

- We will study how the structures and functions of some body system such as endocrine system, circulatory system and respiratory system work together to help the body gets ready to fight a danger (threat) or to run away from it.

الأنظمة تعمل معا:

سوف ندرس كيفية عمل تركيب ووظائف بعض أجهزة الجسم مثل جهاز الغدد الصماء والجهاز الدوري والجهاز التنفسي معا لمساعدة الجسم على الاستعداد لمحاربة الخطر أو الهروب منه.

Endocrine system:

Its structure

It consists of ***glands*** that secrete ***hormones*** that help the body gets ready to respond in different situations.

Its function

It controls the ***body temperature*** and the ***blood pressure***.



Its role during danger:

- When the body faces a danger, it gets ready to fight this danger or to run away from it, where:
  a) The eyes see the danger and send a signal to the brain, then the brain sends a signal to the body to respond to that danger.

b) The **endocrine system** secretes **hormones** that control this respond and affects other body systems to face that danger or to run away from it, such as:

- Contraction of muscles.
- Increasing of breathing rate.
- Increasing of heartbeats.

نظام الغدد الصماء:

تركيبها:

- تتكون من **غدد** تفرز **هرمونات** تساعد الجسم على الاستعداد للاستجابة في المواقف المختلفة.

وظيفتها:

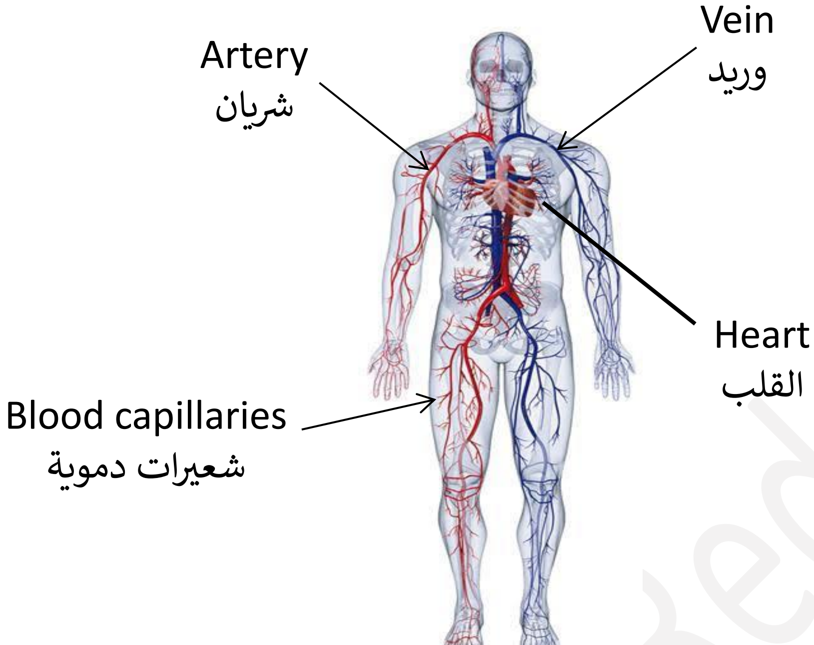
- يتحكم في درجة حرارة الجسم وضغط الدم.

دورها أثناء الخطر:

- عندما يواجه الجسم خطراً ما فإنه يستعد لمقاومة هذا الخطر أو الهروب منه، حيث:

- العين ترى الخطر وترسل إشارة إلى الدماغ، ثم يرسل الدماغ إشارة إلى الجسم للرد على ذلك الخطر.
- يفرز **جهاز الغدد الصماء** **هرمونات** تتحكم في هذه الاستجابة وتؤثر على أجهزة الجسم الأخرى لمواجهة ذلك الخطر أو الهروب منه، مثل:
  - انقباض العضلات.
  - زيادة معدل التنفس.
  - زيادة دقات القلب.

Circulatory system:



Its structure:

- It consists of heart muscle and blood vessels that allow blood to flow through the body.
- The human circulatory system has three different types of blood vessels which are:

  a) ***Arteries***. b) ***Veins***. c) ***Blood capillaries***.

Its function:

- It transports ***blood***, ***gases***, ***nutrients*** and ***hormones*** (secreted by endocrine system) throughout the body.

Its role during danger:

- When the body faces a danger, the heart begins to beat quickly, ***so the heartbeat increase causing***:
  - The heart pumps more blood to the muscles, the heart and the other organs.
  - The blood pressure increases.

الجهاز الدوري:

تركيبها :

- يتكون من عضلة القلب والأوعية الدموية التي تسمح للدم بالتدفق عبر الجسم.
- يحتوي الجهاز الدوري للإنسان على ثلاثة أنواع مختلفة من الأوعية الدموية وهي:

أ) **الشرايين.** ب) **الأوردة.** ج) **الأوعية الدموية.**

وظيفتها:

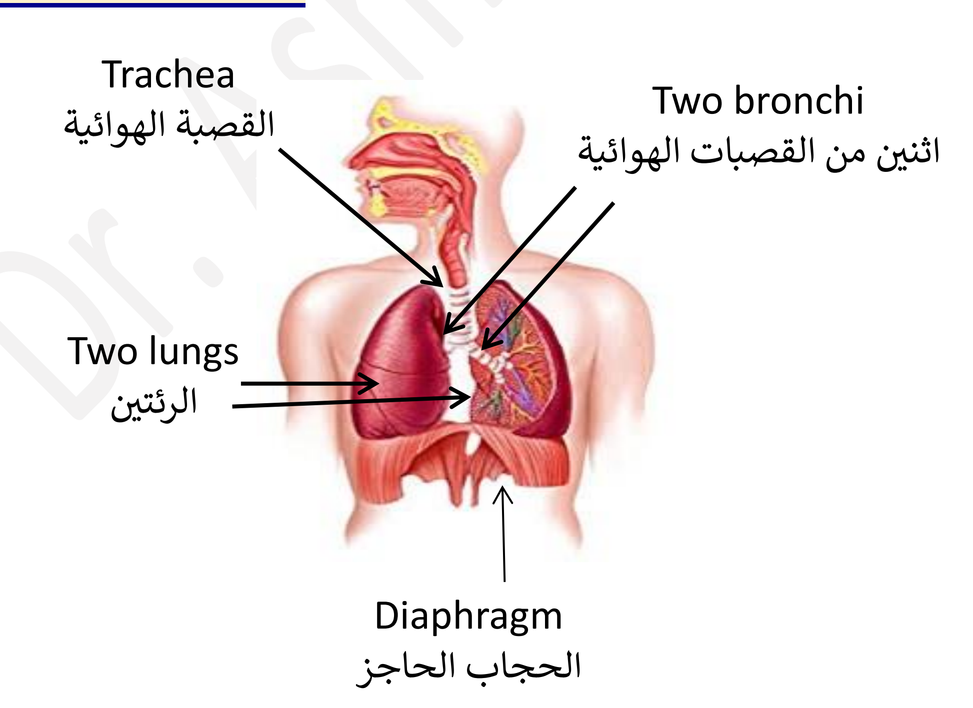
- ينقل **الدم والغازات والمواد المغذية والهرمونات** (التي يفرزها نظام الغدد الصماء) في جميع أنحاء الجسم.

دورها أثناء الخطر:

- عندما يواجه الجسم خطراً ما، يبدأ القلب بالنبض بسرعة، **فتزداد نبضات القلب مما يسبب**:

- يضخ القلب المزيد من الدم إلى العضلات والقلب والأعضاء الأخرى.
- يرتفع ضغط الدم.

Respiratory system:



Its structure:

- It consists of **lungs**, **diaphragm** and **airways** (such as trachea and bronchi).

Its function:

- It provides the body with oxygen gas and gets rid of carbon dioxide gas.

Its role during danger:

- The circulatory system depends on the lungs to do its function, where:
  - When the **diaphragm** muscle **contracts**, the lungs take in the air rich in **oxygen gas**.
  - When the **diaphragm** muscle **relaxes**, the lungs release the air rich in **carbon dioxide gas**.
  - The bloodstream carries oxygen from l organs and other tissues.
  - When the body faces a danger, the **breathing rate increases** and the **heartbeats increase** to allow the body to send **more oxygenated blood** to the muscles and brain.

Diaphragm contracts

Diaphragm relaxes

الجهاز التنفسي:

تركيبها:

- يتكون من **الرئتين والحجاب الحاجز والممرات الهوائية** (مثل القصبة الهوائية والشعب الهوائية).

وظيفتها:

- يمد الجسم بغاز الأكسجين ويتخلص من غاز ثاني أكسيد الكربون.

دورها أثناء الخطر:

- يعتمد الجهاز الدوري على الرئتين للقيام بوظيفته، حيث:

- عندما **تنقبض عضلة الحجاب الحاجز**، تستنشق الرئتان الهواء الغني بغاز **الأكسجين**.
- عندما **تسترخي عضلة الحجاب الحاجز**، تطلق الرئتان الهواء الغني بغاز **ثاني أكسيد الكربون**.
- يحمل مجرى الدم الأكسجين من الرئتين إلى جميع أعضاء الجسم والأنسجة الأخرى.
- عندما يواجه الجسم خطراً ما، **يزداد معدل التنفس وتزداد نبضات القلب** للسماح للجسم بإرسال **المزيد من الدم المحمّل بالأكسجين** إلى العضلات والدماغ.

So, *Different body systems work together to help the body respond to the danger, where:*

1. The ***endocrine system*** releases hormones to fight the danger or to run away from it.
2. The ***circulatory system*** pumps blood quickly around the body carrying oxygen, nutrients and hormones to cells.
3. The ***respiratory system*** provides different organs with oxygen such as muscles and brain.

بالتالي *أجهزة الجسم المختلفة تعمل معًا لمساعدة الجسم على الاستجابة للخطر، حيث:*

1. يفرز **جهاز الغدد الصماء** هرمونات لمحاربة الخطر أو الهروب منه.
2. يضخ **الجهاز الدوري** الدم بسرعة حول الجسم حاملاً الأكسجين والمواد المغذية والهرمونات إلى الخلايا.
3. يقوم **الجهاز التنفسي** بتزويد الأعضاء المختلفة بالأكسجين مثل العضلات والدماغ.

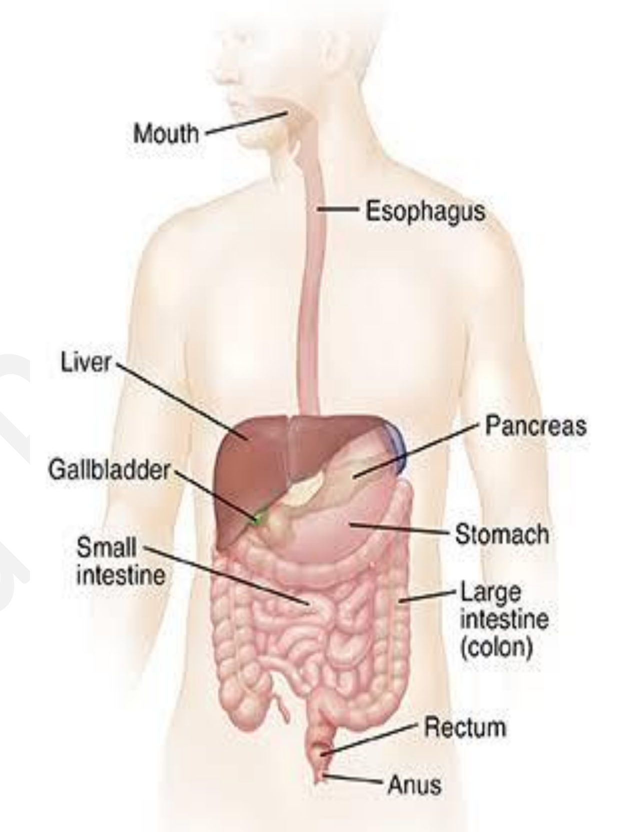


Getting fuel

Getting fuel (energy):

- The body systems work together to keep the body working in a correct way.

So, these systems need energy from food we eat to do their functions.



- Food contains different nutrients such as: carbohydrates, fats and proteins.
- The complex nutrients must be converted into simpler substances before they can be used by body cells.
- The human digestive system converts the complex food into simpler substances that the body can use for energy and growth in a process called "***Digestion process***".

→ Inside the cells, some of simpler substances are used in cellular respiration process.

الحصول على الوقود (الطاقة):

- تعمل أجهزة الجسم معًا للحفاظ على عمل الجسم بطريقة صحيحة.

لذا، تحتاج هذه الأنظمة إلى الطاقة من الطعام الذي نتناوله للقيام بوظائفها.

- يحتوي الغذاء على عناصر غذائية مختلفة مثل: الكربوهيدرات، والدهون، والبروتينات.
- يجب تحويل العناصر الغذائية المعقدة إلى مواد أبسط قبل أن تتمكن خلايا الجسم من استخدامها.

❖ يقوم الجهاز الهضمي للإنسان بتحويل الأغذية المعقدة إلى مواد أبسط يمكن للجسم استخدامها للطاقة والنمو في عملية تسمى "***عملية الهضم***".

← داخل الخلايا، يتم استخدام بعض المواد البسيطة في عملية التنفس الخلوي.

Digestion process

1

- Digestion begins when you put food in your **mouth**.
- Jaw muscles move to help your teeth to chew the food.
- Chewing breaks up the food into smaller parts to help chemicals (enzymes) secreted by endocrine system to digest food easily.
- When you chew food, saliva (a liquid in your mouth that contains enzyme) can easily soften the food and begins the chemical breakdown of food.

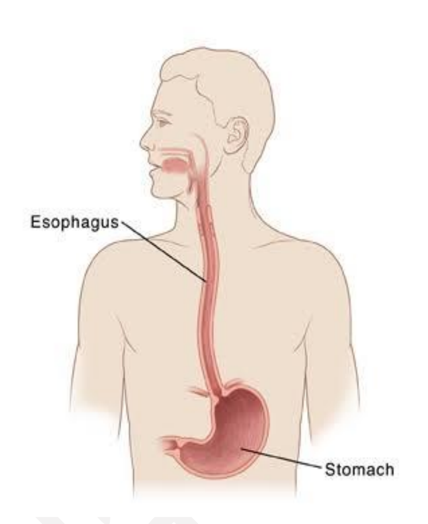


عملية الهضم:

- تبدأ عملية الهضم عندما تضع الطعام في **فمك**.
- تتحرك عضلات الفك لتساعد أسنانك على مضغ الطعام.
- يؤدي المضغ إلى تفتيت الطعام إلى أجزاء أصغر لمساعدة المواد الكيميائية (الإنزيمات) التي يفرزها جهاز الغدد الصماء على هضم الطعام بسهولة.
- عندما تمضغ الطعام، فإن اللعاب (السائل الموجود في فمك والذي يحتوي على إنزيم) يمكن أن يلين الطعام بسهولة ويبدأ في التحلل الكيميائي للطعام.



2

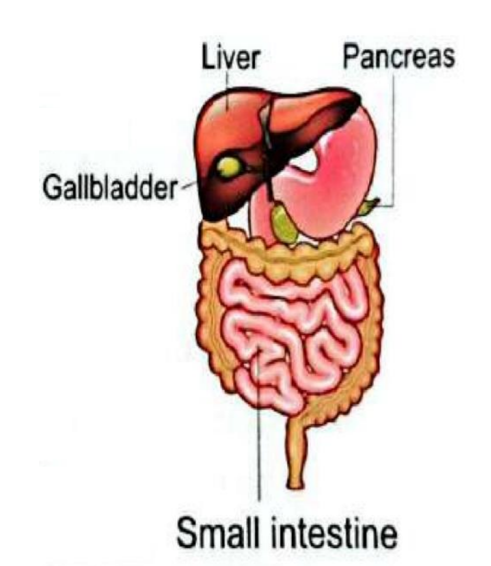


- After you swallow the food, muscles push it down to your **esophagus**, then to **stomach**.
- The continuous churning movement of the stomach and secreting the **stomach's digestive fluids** that contain an acid and some enzymes leads to more food breakdown.

- بعد أن تبتلع الطعام، تدفعه العضلات إلى الأسفل إلى **المريء**، ثم إلى **المعدة**.
- تؤدي حركة التقلب المستمرة للمعدة **وإفراز السوائل الهضمية في المعدة** والتي تحتوي على حمض وبعض الإنزيمات إلى مزيد من تفتيت الطعام.

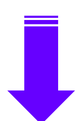


3



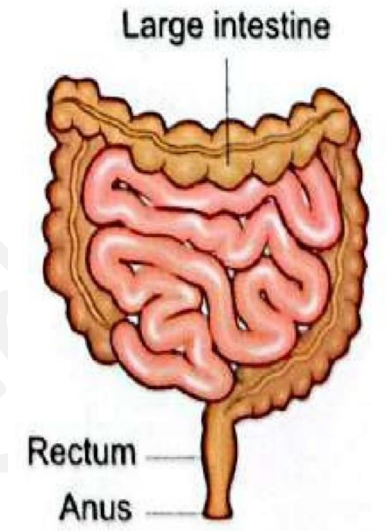
- Enzymes secreted from pancreas and gallbladder help in the chemical breakdown of food once it moves into the small intestine.
- Absorption of nutrients (digested food) starts in the **small intestine**.
- The walls of the small intestine absorb these nutrients through blood vessels to carry them to all the body parts.

- تساعد الإنزيمات التي تفرز من البنكرياس والمرارة في عملية التحلل الكيميائي للطعام بمجرد انتقاله إلى **الأمعاء الدقيقة**.
- يبدأ امتصاص العناصر الغذائية (الطعام المهضوم) في الأمعاء الدقيقة.
- تمتص جدران الأمعاء الدقيقة هذه العناصر الغذائية عن طريق الأوعية الدموية لتحملها إلى جميع أجزاء الجسم.



- The undigested food is passed to the **large intestine** which is also known as colon as a **soupy mixture**.
- Then, the large intestine absorbs most of water from the undigested food that leaves the body as solid mass known as feces or stool.
- The last part of the large intestine is known as rectum that stores the feces until it leaves the body.
- The feces leaves the body through a muscular opening at the end of the rectum known as anus.

4



- يتم تمرير الطعام غير المهضوم إلى **الأمعاء الغليظة** والتي تعرف أيضاً بالقولون **كخليط حساء**.
- بعد ذلك، تمتص الأمعاء الغليظة معظم الماء من الطعام غير المهضوم الذي يترك الجسم على شكل كتلة صلبة تعرف بالبراز .
- الجزء الأخير من الأمعاء الغليظة يعرف بالمستقيم الذي يخزن البراز حتى يخرج من الجسم.
- ويخرج البراز من الجسم من خلال فتحة عضلية في نهاية المستقيم تعرف باسم فتحة الشرج.

Transporting nutrients

- Nutrients are transported to different organs through the circulatory system.
- Some nutrients are used at once and others are stored as sugar and **fats**.

Example:

The liver and muscles can store **glucose sugar** and convert it into a special storage substance called **glycogen**.

The liver and muscles convert **glycogen** into **glucose sugar** again and release it when your body needs energy.

Your body needs this energy when you are exposed to a danger situation to fight this danger or to run away from it.

نقل العناصر الغذائية:

- يتم نقل العناصر الغذائية إلى الأعضاء المختلفة من خلال الدورة الدموية.
- يتم استخدام بعض العناصر الغذائية مرة واحدة ويتم تخزين البعض الآخر على شكل سكر **ودهون**.

مثال:

يستطيع الكبد والعضلات تخزين **سكر الجلوكوز** وتحويله إلى مادة تخزين خاصة تسمى **الجليكوجين**.

يقوم الكبد والعضلات بتحويل **الجليكوجين** إلى **سكر جلوكوز** مرة أخرى ويطلقه عندما يحتاج جسمك إلى الطاقة.

يحتاج جسمك إلى هذه الطاقة عندما تتعرض لموقف خطر ليتمكن من مقاومة هذا الخطر أو الهروب منه.

The Excretory System

- The body must get enough food, water and air to do its function in a correct way.
- Not all the materials we eat are useful. Also, some of the vital processes that occur in our bodies produce waste materials.

But, how does the body get rid of these waste materials?

- The waste materials leave the body through the ***excretory system*** in a process called ***excretion process***.

Excretory system	It is a system that is responsible for storing and getting rid of waste materials produced from cells.

Excretion process:

- It is one of the important vital processes inside the body, where the excretory system collects the waste materials produced by cells and removes them from the body.
- The excretion process is necessary to remove the waste materials resulting from burning food inside the body cells through their membranes.
- If your body doesn't get rid of waste, you will get sick.
- The digestive system doesn't share in excretion process, where it doesn't work on the waste materials produced from burning food inside the body cells.

What are the body parts responsible for excretion process?

1. Skin.
2. Respiratory system
3. Urinary system

جهاز الإخراج

- يجب أن يحصل الجسم على ما يكفيه من الغذاء والماء والهواء ليقوم بوظيفته بطريقة صحيحة.
- ليست كل المواد التي نتناولها مفيدة. كما أن بعض العمليات الحيوية التي تحدث في أجسامنا تنتج فضلات.

ولكن كيف يتخلص الجسم من هذه الفضلات؟

- تغادر النفايات الجسم من خلال ***جهاز الإخراج*** في عملية تسمى ***عملية الإخراج***.

الجهاز الإخراجي:

هو النظام المسؤول عن تخزين والتخلص من النفايات التي تنتجها الخلايا.

عملية الإخراج:

- وهي من العمليات الحيوية المهمة داخل الجسم، حيث يقوم الجهاز الإخراجي بتجميع الفضلات التي تنتجها الخلايا ويخرجها من الجسم.
- عملية الإفراز ضرورية لإزالة الفضلات الناتجة عن احتراق الطعام داخل خلايا الجسم عبر أغشيتها.
- إذا لم يتخلص جسمك من الفضلات، فسوف تمرض.
- لا يشارك الجهاز الهضمي في عملية الإخراج، حيث لا يعمل على التخلص من الفضلات الناتجة عن حرق الطعام داخل خلايا الجسم.

ما هي أعضاء الجسم المسؤولة عن عملية الإفراز؟

1. الجلد.
2. الجهاز التنفسي
3. الجهاز البولي

skin

When you sweat, waste leaves the body through pores in your skin.

الجلد

عندما تتعرق، تخرج الفضلات من الجسم من خلال المسام الموجودة في جلدك.



Respiratory system

When you exhale, your body gets rid of another waste material which is carbon dioxide.

الجهاز التنفسي

عند الزفير، يتخلص جسمك من مادة نفايات أخرى وهي ثاني أكسيد الكربون.



Urinary system

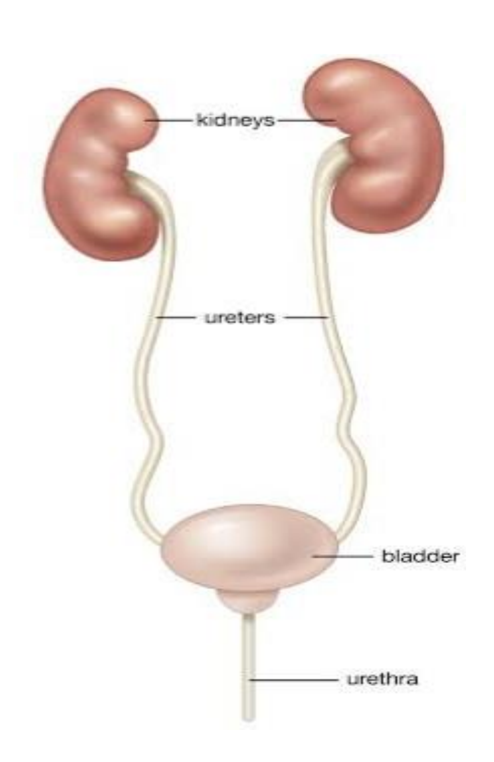
Its structure:

It consists of:

- Two kidneys.
- Bladder.
- Ureters.
- Urethra.

Its function:

It removes waste materials from the blood in the form of urine.



الجهاز البولي

تركيبها:

تتكون من:

- كليتين.
- مثانة.
- الحالب.
- الإحليل.

وظيفتها:

يزيل الفضلات من الدم على شكل بول.

Two kidneys:

- ***They play a very Important role in the urinary system as they continuously clean and filter the blood up to 300 times a day, where:***

  - A large artery brings blood to each kidney.
  - Tiny blood vessels branch off and pass through each **nephron** which is a microscopic filter that filters the blood and removes harmful substances from the body.



  - One of the most important waste materials removed by the kidney is called **urea** which is formed due to the breakdown of proteins Inside the body cells.



  - After the filtering is completed urea, other waste materials and water become **urine**.



- Urine leaves each kidney through a narrow tube called **ureter** and collects in the **bladder**.



- Urine is removed from the bladder through another tube called the **urethra**.

- Blood cells and proteins are too large to pass through the filter (nephron), so they stay in the body.
- Urination is the process of expelling urine from the body.

الكليتين:

- **تلعب دوراً هاماً جداً في الجهاز البولي حيث تقوم بتنظيف وتصفية الدم بشكل مستمر حتى 300 مرة في اليوم، حيث:**
  - شريان كبير ينقل الدم إلى كل كلية.
  - تتفرع أوعية دموية صغيرة وتمر عبر كل **نفرون** وهو عبارة عن مرشح مجهري يقوم بتصفية الدم وإخراج المواد الضارة من الجسم.
  - من أهم النفايات التي تتخلص منها الكلى ما يسمى **باليوريا** والتي تتشكل بسبب تحلل البروتينات داخل خلايا الجسم.
  - بعد الانتهاء من تصفية اليوريا، تتحول النفايات الأخرى والماء إلى **بول**.
  - يخرج البول من كل كلية من خلال أنبوب ضيق يسمى **الحالب** ويتجمع في **المثانة**.
  - تتم إزالة البول من المثانة من خلال أنبوب آخر يسمى **مجرى البول**.
- خلايا الدم والبروتينات كبيرة جدًا بحيث لا يمكنها المرور عبر المرشح (النفرون)، لذا تبقى في الجسم.
- التبول هو عملية طرد البول من الجسم.



Getting rid of waste

- We will do an experiment to show how the kidney model is similar to the real kidney to filter the blood from waste materials.

سوف نقوم بتجربة لتوضيح مدى تشابه نموذج الكلية مع الكلية الحقيقية في تصفية الدم من الفضلات.

Tools:



Cone-shaped filter (represents the nephron)
مرشح مخروطي الشكل (يمثل النيفرون)



Beaker
كوب



Funnel
قمع



Water
ماء



Some salt (represents urea)
بعض الملح (يمثل اليوريا)



Some red kidney beans (represent blood cells)
بعض الفاصوليا الحمراء (تمثل خلايا الدم)

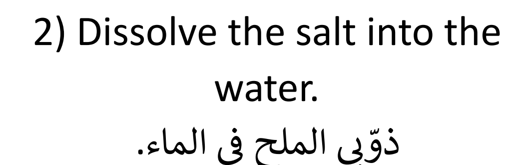


Some rice (represents proteins)
بعض الأرز (يمثل البروتينات)

Steps:

1) Place the filter into the funnel, then put them into the beaker.
ضع الفلتر في القمع، ثم ضعه في الدورق.

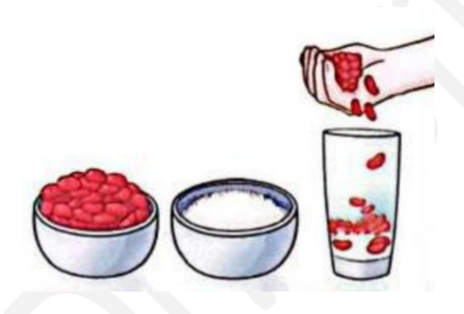




2) Dissolve the salt into the water.
ذوّبي الملح في الماء.



3) Add the red kidney beans and rice into the water.
أضف الفاصوليا الحمراء والأرز إلى الماء.



4) Pour the mixture into the filter.
صب الخليط في الفلتر.



Observations

- The water that contains salt (they represent the urine) passes through the filter.
- The red kidney beans and the rice don't pass through the filter.

- يمر الماء الذي يحتوي على ملح (يمثل البول) عبر الفلتر.
- لا تمر الفاصوليا الحمراء والأرز عبر الفلتر.



Conclusion:

- ***The kidneys work as a filtering system for the blood, where:***
  - When the blood enters the kidneys, they remove some waste materials that come out as urine.
  - Blood cells and proteins are too large, so they don't pass through the kidneys' nephrons.

تعمل الكلى كنظام تصفية للدم، حيث:

- عندما يدخل الدم إلى الكليتين، تقومان بإزالة بعض الفضلات التي تخرج على شكل بول.
- خلايا الدم والبروتينات كبيرة جدًا، لذا لا تمر عبر النيفرونات في الكلى.

- Studying a kidney model instead of a real kidney saves time, money and effort, and saves people's life.

إن دراسة نموذج الكلى بدلا من الكلية الحقيقة يوفر الوقت والمال والجهد وينقذ حياة الناس.

Systems Working Together:

- Different body systems must work together to get energy and nutrients from food we eat to keep the body healthy.
- Each system depends on all the other systems, where if one system does not do its function, the other systems will not be able to do their functions well.

- أجهزة الجسم المختلفة يجب أن تعمل معًا للحصول على الطاقة والمواد المغذية من الطعام الذي نتناوله للحفاظ على صحة الجسم.
- يعتمد كل نظام على جميع الأنظمة الأخرى، حيث إذا لم يقوم أحد الأنظمة بوظيفته، فلن تتمكن الأنظمة الأخرى من القيام بوظائفها بشكل جيد.



Diabetes disease:

- *Diabetes disease* is one of the disorders of the endocrine system.
- People with diabetes disease are unable to make or use insulin, so sugar stays in the blood and causes many problems.
- *Pancreas* is one of the organs of endocrine system that produces ***insulin hormone***, where:
  - If pancreas does its function correctly, it produces the right amount of insulin to regulate the sugar level in blood.
  - If pancreas doesn't do its function correctly, people will be infected with ***diabetes disease***.
  - So, these people must monitor the level of sugar in their blood and not allow it to get too low or too high.



Insulin hormone regulates the amount of sugar that the body can use for energy.

مرض السكري:

- *مرض السكري* هو أحد اضطرابات نظام الغدد الصماء.
- لا يتمكن الأشخاص المصابون بمرض السكري من إنتاج أو استخدام الأنسولين، لذلك يبقى السكر في الدم ويسبب العديد من المشاكل.
- *البنكرياس* هو أحد أعضاء جهاز الغدد الصماء الذي يقوم بإنتاج ***هرمون الأنسولين***، حيث:

- إذا قام البنكرياس بوظيفته بشكل صحيح، فإنه ينتج الكمية المناسبة من الأنسولين لتنظيم مستوى السكر في الدم.
- إذا لم يقوم البنكرياس بوظيفته بشكل صحيح، فسيصاب الإنسان ***بمرض السكري***.
- لذا، يجب على هؤلاء الأشخاص مراقبة مستوى السكر في الدم وعدم السماح له بالانخفاض أو الارتفاع الشديد.

ينظم هرمون الأنسولين كمية السكر التي يمكن للجسم استخدامها للطاقة.

How to use technology to treat diabetes?

- There are many kinds of technologies used to treat diabetes and for diabetics to monitor their condition from home.
- Diabetics must give themselves regular shots (doses) of insulin.
- An ***insulin pump*** ***is a device attached to the body to help diabetics control the blood sugar levels with automatic injections of insulin***.

A) Researchers are now working to develop an artificial pancreas, so people infected with diabetes don't need the external pump.
B) This artificial pancreas will be an internal organ that pumps insulin as needed.

كيف تستخدم التكنولوجيا لعلاج مرض السكري؟

- هناك العديد من أنواع التقنيات المستخدمة لعلاج مرض السكري ولمرضى السكر لمراقبة حالتهم من المنزل.
- يجب على مرضى السكر إعطاء أنفسهم جرعات منتظمة من الأنسولين.

- ***مضخة الأنسولين*** هي **جهاز متصل بالجسم لمساعدة مرضى السكري على التحكم في مستويات السكر في الدم عن طريق الحقن التلقائي للأنسولين.**

أ) ويعمل الباحثون الآن على تطوير بنكرياس صناعي، بحيث لا يحتاج المصابون بمرض السكري إلى المضخة الخارجية.

ب)سيكون هذا البنكرياس الاصطناعي عضوًا داخليًا يضخ الأنسولين حسب الحاجة.

Unit 1 – Concept 2
{ The body as a system }

nervous	عصبي	heartbeats	نبضات القلب
pain	ألم	danger response	الاستجابة للخطر
building living systems	تركيب الأنظمة الحية	endocrine system	جهاز الغدد الصماء
skeletal system	الجهاز الهيكلي	provide	يزوّد
function	وظيفة	integrated way	طريقة متكاملة
fracture healing	شفاء الكسور	systems	أجهزة
cyclist	راكب دراجة	dangerous situation	موقف خطير
physical response	استجابة حسية	signal	إشارة
contract	ينقبض	face	يواجه
muscles	عضلات	interaction	تفاعل
muscular system	الجهاز العضلي	nerve cells	خلايا عصبية
coordinate	ينسّق	instructions	تعليمات
building blocks	وحدات بناء	multicellular organism	كائن عديد الخلايا
cells	خلايا	muscle cells	خلايا عضلية
specialized	متخصص	bundle	تتجمع
fibers	ألياف	effective	فعّال

organs	أعضاء	tissues	أنسجة
elbow	المرفق	shoulder	الكتف
musculoskeletal system	الجهاز العضلي الهيكلي	ligaments	أربطة
cartilages	غضاريف	bones	عظام
tendons	أوتار	tasks	مهام
contraction	انقباض	relaxation	انبساط
forearm	الساعد	relax	ينبسط
voluntary muscles	عضلات إرادية	involuntary muscles	عضلات لاإرادية
cardiac muscle	عضلة القلب	abdomen muscles	عضلات البطن
upper arm muscles	عضلات الذراع العلوية	forearm muscles	عضلات الساعد
bend	يثني	straighten	يفرد
palm	راحة اليد	waist muscle	عضلات الخصر
twist	يدير	glands	غدد
hormones	هرمونات	arteries	شرايين
blood vessels	أوعية دموية	blood capillaries	شعيرات دموية
breathing rate	معدّل التنفس	respond	يستجيب
veins	أوردة	diaphragm	الحجاب الحاجز
airways	ممرات هوائية	get rid of	التخلص من

bloodstream	مجرى الدم	oxygenated blood	الدم المحمّل بالأكسجين
getting fuel	الحصول على الطاقة	carbohydrates	الكربوهيدرات
proteins	البروتينات	fats	الدهون
complex nutrients	العناصر الغذائية المعّقدة	simpler substances	مواد أبسط
cellular respiration process	عملية التنفس الخلوي	digestion process	عملية الهضم
growth	النمو	jaw muscles	عضلات الفك
chew	مضغ	saliva	اللعاب
oesophagus	البلعوم	gall bladder	الحويصلة الصفراوية
stomach's digestive fluids	السوائل الهاضمة من المعدة	churning movement	الحركة النموذجية
rectum	المستقيم	anus	فتحة الشرج
small intestine	الأمعاء الدقيقة	large intestine	الأمعاء الغليظة
soupy mixture	مزيج شبه سائل	feces / stool	البراز
Storage substance	مادة تخزين خاصة	glycogen	الجليكوجين
excretion process	عملية الإخراج	urinary system	الجهاز البولي

skin	الجلد	pores	مسام
kidney	الكلية	bladder	المثانة
urethra	الإحليل	urine	البول
urination	التبوّل	filtering system	جهاز ترشيح
special devices	أجهزة خاصة	represent	يمثّل
model	نموذج	properly	بطريقة صحيحة
instead of	بدلا من	save	يوفّر
effort	الجهد	bite	قضمة
remove	يزيل	artificial	صناعي
diabetes disease	مرض السكر	diabetics	مرضى السكر
technologies	التقنيات	researchers	الباحثون
vital processes	عمليات حيوية	shots	جرعات
injection	الحقن	insulin pump	مضخة الأنسولين
mighty muscle	عضلات قوية		

Unit 1 – concept 2 - questions

Lesson 1

Choose the correct answer:

1. When you feel nervous, your heartbeats increase, this indicates the interaction between ………………… systems.
   a. digestive and nervous
   b. digestive and circulatory
   c. nervous and circulatory
   d. digestive and respiratory

2. Skeletal system takes nutrients from ………….. system for growth of muscles.
   a. circulatory b. digestive c. nervous d. respiratory

3. When you touch a hot cup of tea, …………………… system sends a message to the muscles of your hand to contract.
   a. respiratory b. digestive c. circulatory d. nervous

4. In a dangerous situation, your eyes send the information to the …………………… to perform the suitable action.
   a. brain b. stomach c. lungs d. heart

5. Muscles of stomach and muscles of heart can be controlled by ……………….. system.
   a. digestive b. circulatory c. nervous d. respiratory

6. The nerve cells depend on …………………. systems to get their needed nutrients.
   a. digestive and respiratory
   b. digestive and circulatory
   c. circulatory and respiratory
   d. circulatory and nervous

7. The system which transfers nutrients from the digestive system to the different muscles of the body is the ………………… system.
   a. circulatory
   b. nervous
   c. respiratory
   d. excretory

8. In dangerous situations, ………..…………
   a. all systems of the body interact together.
   b. circulatory system interacts with digestive system only.
   c. nervous system sends message to digest food in stomach.
   d. respiratory system interacts with circulatory system only.

<u>Put (√) or (x):</u>

1- All systems in your body work together in an integrated way. (   )

2- When you hear a clock alarm, your brain sends a signal to the muscles to move and wake up. (   )

3- In dangerous situations, nervous system only allows your body to face the danger. (   )

4- Digestive system can digest food without the help of nervous system. (   )

5- Muscles of heart are controlled by nervous system. (   )

6- Nutrients reach the nerve cells which found in your hand by the help of circulatory system. (   )

7- Digestive system transfers oxygen gas to all muscles in your body. (   )

Complete the following sentences using the words below:

(body systems – blood – nervous – nutrients – muscles – brain)

1) When you feel nervous, there is an interaction between circulatory system and ……………… system.
2) When you touch a sharp thorn, your hand moves away quickly due to the interaction between nervous system and ………………… in your hand.
3) When you smell a fire smoke, the …………………………. sends a message to your leg muscles to walk toward the fire location.
4) The interaction between …………………… is important in any dangerous situation.
5) Digestive system provides the nerve cells with …………………… which are needed to perform their functions.
6) Nutrients are transmitted from digestive system to nervous system through the …………………………. In the circulatory system.

Give reasons for:

- Digestive system helps skeletal system in fracture healing.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The nerve cells in the nervous system need nutrients.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The importance of nervous system for the muscles of heart.

……………………………………………………………………………………………

……………………………………………………………………………………………

<u>What happens to …:</u>

- The brain of a cyclist when he sees a dangerous situation.

……………………………………………………………………………………………

……………………………………………………………………………………………

<u>Use the following systems to complete the table below:</u>

(you can use the same system more than once)

(Digestive system – Circulatory system – Nervous system)

Description	Name of system
1. It controls the muscles of stomach.	………………………………………
2. It transmits nutrients from digestive system to the nerve cells.	………………………………………
3. It provides the muscles of heart with its needed food.	………………………………………

4. It controls the muscles of heart.	…………………………………………
5. They help in providing and transmitting the nutrients to the muscles of arms.	………………………………………..

Lesson 2

Choose the correct answer:

1. Cells differ from each other in ………………………
   a. shapes only
   b. sizes only
   c. shapes and sizes
   d. neither shapes nor sizes

2. All the following are from the characteristics of muscle cells, except that they ……………………….
   a. Are in the form of long fibers.
   b. can work alone due to their large sizes.
   c. must be able to store and use energy quickly.
   d. can be bundled together to form tissues.

3. The muscle is considered as …………………
   a. a cell b. a tissue c. an organ d. a system

4. Among the organs of musculoskeletal system are ………………….
   a. muscles and bones of arm.
   b. muscles of arm and lungs.
   c. bones and heart.
   d. lungs and heart.

5. Musculoskeletal system allow the body to …………………
   a. digest food.
   b. move from place to another.
   c. transmit nutrients.
   d. exchange oxygen and carbon dioxide.

6. Your leg moves due to contraction and relaxation of …………………. connected to the bon of leg.
   a. hairs   b. toes   c. skin   d. muscles

7. When the muscle in front of the upper arm contracts and the muscle in the back of the upper arm relaxes, the forearm moves ……………………
   a. up towards your shoulder.
   b. down towards your shoulder.
   c. up away from your shoulder.
   d. down away from your shoulder.

8. When the muscles in front of the upper arm relax and the muscles in the back of the upper arm contract, the forearm moves ……………………………….
   a. up towards your shoulder.
   b. down towards your shoulder.
   c. up away from your shoulder.
   d. down away from your shoulder.

9. The contraction of muscles moves the bones in ………. only.
   a. one direction   c. four directions
   b. two directions   d. three directions

10. You can move your fingers due to the contraction and relaxation of the skeletal muscles that attached to the …………………… of your fingers.

a. hairs   b. bones   c. skin   d. nails

11. All the following organs belong to musculoskeletal system, except ………………..

a. tendons   b. cartilages   c. veins   d. bones

<u>Choose from column (B) what suits it in column (A):</u>

(A)	(B)
1. A group of similar cells form 2. A group of different tissues form 3. A group of different organs form 4. A group of different systems form	a. organs. b. cells. c. whole body. d. tissues. e. systems.

<u>Put (√) or (x):</u>

1- A group of different tissues can form a system. (   )

2- Muscle cells are in the form of long fibers to allow movement. (   )

3- Muscle cells cannot store and use energy quickly. (   )

4- The muscle is formed from bundles of muscle tissues. (   )

5- Musculoskeletal system consists of muscular system and digestive system. (   )

6- The body can move by the help of the skeletal system only. (   )

7- The forearm moves up towards your shoulder when the muscle in front of the upper arm contracts. (   )

8- Contraction and relaxation of leg muscles allow the bones of leg to move. (   )

9- Musculoskeletal system consists of muscles and bones only. (   )

Write the scientific term of each of the following:

- They are cells in the form of long fibers to allow movement. (…………………………………………..)
- It is the organ which contracts and relaxes to help in the movement of the body. (……………………………………)
- The system which helps the body to move. (……………………………………)
- They are muscles that attached to the bones of skeletal system. (…………………………………………..)

Complete the following sentences:

1) The body consists of a group of ……………………… which consists of a group of organs.
2) Skeletal muscles can store and use ………………………. quickly.
3) Bundles of muscle tissues are organized to form the …………………………….

4) Musculoskeletal system consists of two systems which are and ……………… system and …………………… system that allow the …………………… of the body.
5) When you lift a bag by your hand toward your shoulder, muscles in front of the upper arm ……………………… and muscles in the back of the upper arm ……………………………
6) When a muscle contracts, it can exert ………………………………
7) When you push a door with your hand, the skeletal muscles that found in your arm work in pairs and move in …………………………… directions.

Give reasons for:

- Muscle cells are in the form of long fibers.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- Muscle cells don't work alone.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- Skeletal system cannot do the function of movement without muscular system.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

What happens to…:

❖ Your leg if the muscles found in it are damaged.

………………………………………………………………………………………………

………………………………………………………………………………………………

❖ The muscles in front of the upper arm and muscles in the back of the upper a when the forearm moves down away from your shoulder.

………………………………………………………………………………………………

………………………………………………………………………………………………

Look at the following figures, then complete the following sentences:



A) The forearm in figure ……….. moves up toward your shoulder.

B) The forearm in figure ……….. moves down away from your shoulder.

C) The muscles in front of the upper arm contract in figure ………….. and relax in figure …………..

D) The muscles in the back of the upper arm contract in figure ………… and relax in figure …………

Lesson 3

Choose the correct answer:

1. Among the muscles which you cannot control their movement are …………………
   a. hand muscles c. leg muscles
   b. eyelid muscles d. arm muscles

2. Cardiac muscles are type of involuntary muscles which form the …………………
   a. stomach b. intestine c. lungs d. heart

3. Muscles of heart ………………… to pump the blood carrying oxygen to all body cells.
   a. contract only c. contract and relax
   b. relax only d. neither contract nor relax

4. Among the organs which contain both involuntary and voluntary muscles is the ………………..
   a. heart b. arm c. eye d. leg

5. Skeletal muscles work in pairs when …………………
   a. moving your hands towards your shoulder
   b. pumping blood to all the body parts.
   c. transmitting food to all the body parts.
   d. closing your eyelid to allow you blink.

6. The system which helps your body gets ready to respond in different situation: by secreting hormones is the .... system.
   a. digestive   b. endocrine   c. circulatory   d. nervous

7. Among the functions of endocrine system is ……………………
   a. transmitting food to the nervous system.
   b. controlling the muscles of stomach.
   c. controlling the body temperature and blood pressure.
   d. providing the muscular system with its needed food.

8. All the following are happened by the help of endocrine system to face or to r away from danger, except ....
   a. contraction of your muscles.
   b. increasing your breathing rate.
   c. increasing your heartbeats.
   d. digestion of food that you eat.

9. All the following are from types of blood vessels, except ……………........
   a. arteries   b. heart   c. veins   d. blood capillaries

10. Circulatory system can transport all the following substances through all the body parts, except ………….….
    a. nutrients   b. gases   c. hormones   d. bones

11. When you face a dangerous situation, circulatory system do all the following, except …………………
    a. your heartbeats increase.
    b. muscles of your body relax.
    c. heart pumps more blood to the muscles.
    d. the blood pressure increases.

12. Among the organs which belong to respiratory system is ……………
   a. stomach   b. heart   c. lung   d. brain

13. The system which provides your body with oxygen gas and gets rid of carbon dioxide gas is ……………. system.
   a. respiratory   b. nervous   c. endocrine   e. circulatory

14. The lungs take in air when the diaphragm …………………., while they release the air when the diaphragm …………..
   a. contracts – contracts   c. relaxes - relaxes
   b. contracts – relaxes   d. relaxes - contracts

15. The system which helps the respiratory system in transporting oxygen gas from lungs to all the body organs is the ………… system.
   a. digestive   b. nervous   c. endocrine   d. circulatory

16. All the following muscles work in pairs as one muscle contracts, while the other muscle relaxes, except the …………..
   a. upper arm muscles   c. neck muscles
   b. cardiac muscles   d. forearm muscles.

Put (√) or (x):

1- Cardiac muscles are considered as voluntary muscles. (   )

2- Heart is made of a type of involuntary muscles known as skeletal muscles. (   )

3- Cardiac muscles contract and relax all the time without stopping. (   )

4- The muscles that help you move your eyes in different directions are considered as voluntary muscles. (   )

5- All skeletal muscles are considered as involuntary muscles and work by contraction. (   )

6- Endocrine system secretes hormones that control the increasing of your breathing rate during danger. (   )

7- The heart begins to beat quickly during normal situations. (   )

8- When the heartbeats increase, the blood pressure increases also. (   )

9- Trachea is the only airway through which oxygen passes to reach the lungs. (   )

10- In dangerous situations, the body sends more oxygenated blood to the muscles and brain to face the danger. (   )

11- Blood transports oxygen gas only to all the body organs and tissues. (   )

12- Forearm muscles are considered as voluntary muscles. (   )

<u>Write the scientific term of each of the following :</u>

- They are muscles that move automatically, and you cannot control their movement. (………………………………..)
- They are muscles that you can control their movement. (…………………………………..)

- A type of involuntary muscles which form the heart that contract and relax all time without stopping.

  (………………………………………..)

- They are muscles which allow the movement of the bones of skeletal system. (………………………………………)

- It is the system that secretes hormones to control the body temperature and the blood pressure.

  (…………………………………………..)

- It is the system which consists of the heart and blood vessels that allow blood to flow through the body.

  (……………………………………………….)

- It is the system which consists of lungs and other airways.

  (…………………………………………………..)

<u>Complete the following sentences:</u>

1) Muscles of eyelid that allow you blink many times in one minute are considered as ……………………. muscles, while the muscles that help your eyeball to move in different directions are considered as ……………………. muscles.
2) The muscles of heart are called …………………….. muscles and they are considered as a type of ……………….. muscles.
3) All muscles can do the function of movement by …………………………….

4) Endocrine system consists of …………… which secrete …………………….. that control bod temperature and blood ………………………………..

5) In dangerous situations, endocrine system secretes hormones which allow your …………………… contract and increasing the rate of your ……………………. and …………………………

6) In dangerous situations, heart pumps more blood which carries …………………, …………………. and ……………………… to the muscles and other organs.

7) The lungs release the air that rich in ……………… gas, when the …………………… muscle relaxes.

8) When your heartbeats and breathing rate increase, your body sends more ……………………….. blood to the muscles and brain to face the danger.

9) Among the skeletal muscles that you can control their movement are upper arm muscles, ……………………….. and …………………………………

Give reasons for:

- Cardiac muscles are considered as involuntary muscles.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- Cardiac muscles contract and relax without stopping.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

- The muscles that surround the eyeball are considered as voluntary muscles.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

- When the body faces a danger, the heartbeats increase.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

<u>What happens to…:</u>

- The human body if the cardiac muscles don't contract and relax for a long period of time.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

- The human body when the heartbeats increase during danger.

……………………………………………………………………………………………………

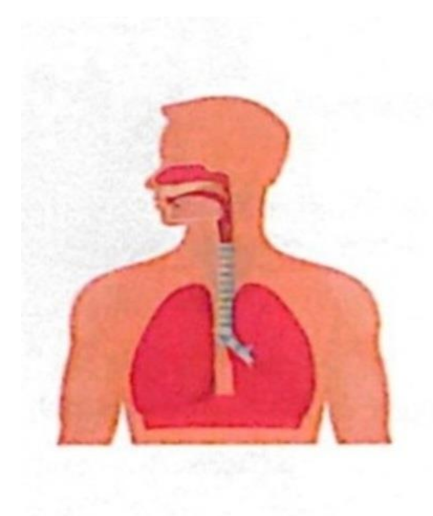
……………………………………………………………………………………………………

❖ The lungs when the diaphragm muscle contracts.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

<u>The following figures show some human body systems, if a person is subjected to an accident while he is riding a bicycle, complete the sentences below:</u>



System (1)



System (2)

A) System number……………. helps endocrine system in carrying hormones to the muscles and brain of the person.

B) Heart that belongs to system number …………… begins to beat quickly.

C) System number …………… contains diaphragm muscle which contracts and relaxes many times to increase the breathing rate.

D) Both system number (1) and (2) help …………………… gas to reach muscles and brain of the person.

Lesson 4

Choose the correct answer :

1. The systems of the human body get their needed energy from …………….
   a. the sun   b. water   c. food   d. carbon dioxide

2. All the following are from the nutrients that the food contains, except ……………….
   a. carbohydrates   b. oxygen gas   c. fats   d. proteins

3. The system which converts the complex food into simpler substances that the body can use for energy and growth is the ……………. system.
   a. respiratory   b. nervous   c. circulatory   d. digestive

4. You can use your …………….. muscles to help the teeth chew the food.
   a. eye   b. cardiac   c. jaw   d. hand

5. The system which helps the digestive system during chewing the food by secreting enzymes in your mouth is the ………………. system.
   a. endocrine   b. circulatory   c. respiratory   d. nervous

6. The function of saliva inside your mouth is ………………….
   a. cutting up the food into smaller parts
   b. softening the food and breaking it down
   c. transporting the food into stomach

d. transporting the food through body organs.

7. The organ which belongs to the digestive system and secretes fluids contain an acid and some enzymes is the ……………………………..
   a. esophagus b. stomach c. small intestine d. mouth

8. In small intestine, …………………. help(s) in breaking down of food by secreting some enzymes.
   a. pancreas only c. pancreas and gallbladder
   b. gallbladder only d. pancreas and lungs

9. Absorption of nutrients inside the body starts in the ……………..… organ.
   a. large intestine c. heart
   b. small intestine d. stomach

10. Walls of small intestine contain ……………………. which responsible for absorbing nutrients of digested food.
   a. blood vessels b. hairs c. glands d. nephrons

11. Blood carries ………………… formed inside small intestine to all the body organs.
   a. feces b. undigested food c. bones d. nutrients

12. The large intestine absorbs ……………. from the undigested food.
   a. nutrients b. water c. blood d. urea

13. The part of large intestine which stores the feces until it leaves the body is the …………………

a. rectum b. colon c. esophagus d. anus

14. The organs which can store glucose and convert it into glycogen are ………………….
    a. liver and pancreas
    b. muscles and stomach
    c. esophagus and stomach
    d. liver and muscles

15. The system which helps the digestive system in transporting the nutrients to all different body organs is the …………… system.
    a. nervous b. respiratory c. circulatory d. excretory

16. The body gets rid of waste materials by …………….. process.
    a. digestion b. excretion c. respiration d. sensation

17. The excretion process is necessary to ……….
    a. digest the food that you eat.
    b. allow your body to move.
    c. transport the nutrients inside your body.
    d. remove the waste products from your body.

18. All the following are responsible for excretion process, except ……………..
    a. digestive system
    b. skin
    c. respiratory system
    d. urinary system

19. The organ which is responsible for secreting sweat is the …………
    a. esophagus b. stomach c. skin d. kidney

20. All the following are from the waste materials which are produced by your body, <u>except</u> …………..
    a. urine b. oxygen gas c. carbon dioxide d. sweat

21. Among the organs which belong to urinary system are ………..

a. stomach and kidneys c. kidneys and bladder
b. ureters and gallbladder d. urethra and heart

22. The two kidneys play an important role in the filtration of ……………. inside your body.

a. water b. enzyme c. acid d. blood

23. The blood which carries the waste materials, enters each kidney through a large …………..

a. vein b. artery c. blood capillary d. ureter

24. Urea is formed due to the breaking down of ……… inside the body cells.

a. Carbohydrates b. fats c. acids d. proteins

25. The tube which transports the urine from the kidney to the bladder is the ……………..

a. vein b. urethra c. ureter d. artery

26. The process of expelling urine from the body is called ……………… process.

a. urination b. respiration c. digestion d. sensation

<u>Put (√) or (x):</u>

1- Systems get their needed energy from the food we eat. ( )
2- The simple substances must be converted into complex nutrients to be used by the body cells. ( )
3- Digestion begins when the food enters esophagus. ( )

4- Saliva is a liquid which is secreted by endocrine system inside your mouth. ( )

5- The acid and enzymes which are secreted inside stomach lead to more breaking down of food. ( )

6- Inside large intestine, enzymes which are secreted from pancreas and gallbladder help in the chemical breakdown of food. ( )

7- Absorption of digested food starts in the small intestine. ( )

8- The digested food enters the colon as a soupy mixture. ( )

9- Colon absorbs most of water from the undigested food that leaves the body. ( )

10- The feces leave the body through a bony opening known as anus. ( )

11- Circulatory system transports the digested food to different body organs. ( )

12- All nutrients that are absorbed from small intestine are stored as fats inside the body. ( )

13- Glycogen is converted into glucose and stored in liver and muscles. ( )

14- When your body needs energy, liver and muscles convert glycogen into glucose again. ( )

15- Excretion process is necessary to convert complex food into simpler substances. ( )

16- If your body doesn't get rid of waste, you will be healthy. ( )

17- The main waste product which is expelled by respiratory system is the urea. ( )

18- The two kidneys remove waste materials from the blood. ( )

19- Nephron helps in the filtration of blood from urea. ( )

20- Urine is expelled outside the body through urethra. ( )

21- Blood cells and proteins are too small, so they can pass through the nephrons of kidneys. ( )

<u>Write the scientific term of each of the following:</u>

- The system which converts the complex food into simpler substances that the body can use to get energy. (…………………………………)
- The process of breaking down the complex food into simpler substances. (……………………………………)
- A liquid in your mouth contains an enzyme which helps in digestion process. (……………………)
- An organ in which absorption of nutrients starts.

(………………………)

- The organ which absorbs most of water from the undigested food. (……………………..)
- The last part of large intestine that stores the feces until it leaves the body. (………………………………)
- A substance that is stored in liver and muscles, then converted into glucose when your body needs energy.

  (………………………………)
- It is a system that is responsible for storing and getting rid of waste materials produced from cells.

  (………………………………….)
- It is the process of removing the waste products resulting from burning food inside the body cells through their membranes. (………………………………….)
- The organ which helps in excretion of sweat through the pores that are found in it. (…………………………………..)
- The system that is responsible for excretion of carbon dioxide gas. (…………………………………..)
- It is a microscopic filter that is found in the two kidneys and filters the blood from waste materials.

  (………………………………)
- A substance which is formed due to the breakdown of proteins inside the body cells. (………………………………)

- It is the process of expelling urine from the body.

(………………………………………)

<u>Complete the following sentences:</u>

1) The food we eat contains different nutrients such as ………………………. , …………………… and ……………………
2) Your body cells can use simple substances that are converted from complex …………… to get their needed ……………….. to do their functions.
3) The system which helps your teeth and jaw move to chew the food is the ………………… system.
4) Stomach contains an ………………… and some ………………… that lead to more food breakdown.
5) Inside small intestine, …………………… and …………………… secrete enzymes to help in the chemical breakdown of food.
6) After completing the digestion of food, the walls of …………… absorb the nutrients through …………………….. that carry them to all the body parts.
7) Undigested food passes to …………………… intestine which absorbs most of ………………… from it, leaving the solid waste that is known as ………………… or …………………………..
8) The muscular opening that the feces passes through it to outside the body is known as ……………………

9) Cells can use …………………… sugar at once to get their needed energy, and this sugar can be converted into ……………. and stored in liver and ………………………

10) Excretion process happens when …………………. system collects the waste materials produced by ………………. and expels them outside the body.

11) Some waste products leave your body in the form of ………………… through your skin.

12) Respiratory system removes ……………………. gas from the body as a waste product.

13) Urinary system removes waste material from the blood in the form of …………………….

14) Blood which carries waste materials reach the kidney through a large ……………………….

15) Filtration of blood occurs inside the ……………….. by the help of a microscopic filter known as ………………………

16) When you eat a piece of meat, proteins are broken down and form a waste material known as ……………………..

17) Urine is composed of …………………, other waste products and ………………………

18) Urine leaves each kidney through …………………… and is collected in the ……………………. until it is expelled outside the body.

19) Blood cells and …………………… are ………………. in size, so they cannot pass through nephrons, and stay in the body.

Give reasons for:

- The body needs to convert complex food into simpler substance.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Saliva plays an important role in digestion of food inside the mouth.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Stomach secretes a digestive fluid when the food reach it.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Walls of small intestine contain blood vessels.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Undigested food becomes solid wastes inside the large intestine.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The liver and muscles convert the stored glycogen into glucose sugar.

....

....

- Importance of excretion process to your body.

....

....

- The digestive system doesn't share in excretion process.

....

....

- The two kidneys contain many nephrons.

....

....

- Formation of urea inside the body of human.

....

....

What happens if…:

- ❖ Complex nutrients don't convert into simple substances inside your body.

....

……………………………………………………………………………………………

- ❖ Saliva is not secreted during chewing the food inside your mouth.

……………………………………………………………………………………………

……………………………………………………………………………………………

- ❖ Pancreas and gallbladder don't secrete their enzymes in small intestine.

……………………………………………………………………………………………

……………………………………………………………………………………………

- ❖ Your body doesn't get rid of waste.

……………………………………………………………………………………………

……………………………………………………………………………………………

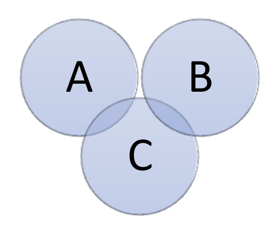
- ❖ The blood that carries waste materials passes through nephrons of the two kidneys.

……………………………………………………………………………………………

……………………………………………………………………………………………

Look at the following diagrams that represent the sharing of some body systems to do some processes, then use the words below to complete the following sentences:

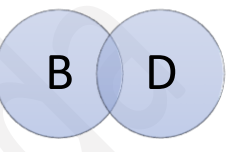
(**respiratory system – skin - urinary system - circulatory system**)



Excretion process

D A

Transportation of waste materials and urination



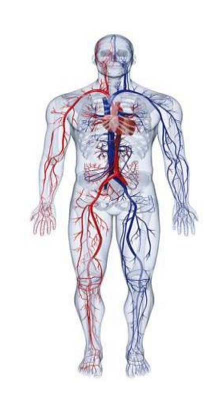
Respiration process and transportation of gases

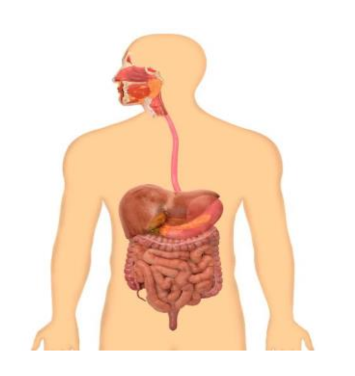
1. Letter (A) represents …………………
2. Letter (B) represents ……………………
3. Letter © represents …………………….
4. Letter (D) represents …………………….

Write each of the following organs below the system that belongs to:

(**Heart - Lungs - Kidneys – Stomach**)









…………………….. …………………….. …………………….. ……………………..

Lesson 5

Choose the correct answer :

1. Engineers design special devices to work instead of …………………….. organ which filter the blood from waste materials.
   a. stomach b. heart c. kidney d. lung

2. Nephrons play an important role in ……………………
   a. secreting hormones to control the body functions.
   b. controlling the movement of body from place to another.
   c. breaking down the complex food into simple nutrients.
   d. filtering the blood from waste materials.

3. Among the substances which cannot pass through the kidneys' nephrons are ……………………….
   a. blood cells and urea c. proteins and urea
   b. blood cells and proteins d. water and urea

4. Urination process happens by the help of …………………. system.
   a. digestive b. urinary c. respiratory d. skeletal

5. The two kidneys remove waste materials as …………………, and expel them in the form of urine.
   a. water and urea c. water and proteins
   b. urea and blood cells d. proteins and blood cells

Put (√) or (x):

1- Kidneys are considered as a filtering system for the blood. (   )

2- People whose kidneys are not working properly must use other devices to filter their blood from waste. (   )

3- Proteins can pass through nephrons during filtration of blood in the two kidneys. (   )

4- Studying a kidney model can save time, money and effort. (   )

5- The two kidneys remove waste materials from undigested food which come out in the form of urine. (   )

Complete the following sentences using the words below:

(**kidney model - proteins – blood - urine - nephrons – urea**)

2) People whose kidneys are not working well, their …………………….. cannot be filtered well.

3) Some substances can pass through nephrons as …………………., while other substances cannot pass through nephrons as ……………………

4) The microscopic filters which are found inside the two kidneys are called ……………………..

5) We can save people's life when studying a ……………………. instead of a real kidney.

6) Waste materials that are removed by the help of urinary system are coming in the form of ………………………….

Give a reason for :

- Blood cells and proteins cannot pass through the kidney's nephrons.

……………………………………………………………………………………………

……………………………………………………………………………………………

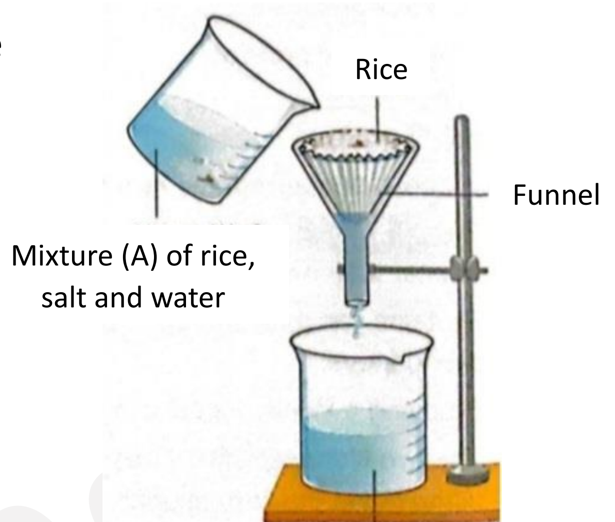
What happens if…:

- The blood does not pass through the two kidneys during its circulation inside the human body.

……………………………………………………………………………………………

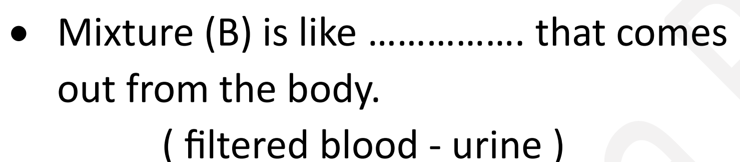
……………………………………………………………………………………………

Look at the opposite figure, then choose the correct answer from those between brackets:



- The filter in the opposite figure is like ………. organ in the urinary system.
  (stomach – kidney)

- Mixture (A) is like ………… which is found in the body.
  (blood before filtering - blood after filtering)



- Mixture (B) is like ……………. that comes out from the body.
  (filtered blood - urine)

- Rice in the opposite figure is like ………. which cannot pass through nephrons during filtration of blood.
  (proteins – urea)

Lesson 6

Choose the correct answer:

1. Diabetes disease occurs due to a disturbance in one organ of ………………… system.
   a. respiratory b. nervous c. endocrine d. urinary

2. The organ which is responsible for secreting insulin hormone is the …………………
   a. gallbladder b. pancreas c. liver d. stomach

3. Insulin hormone is responsible for regulating the level of ……………………… in blood.
   a. proteins b. fats c. water d. sugar

4. Pancreas belongs to …………….. system and its secretions help in completing ……………………… process.
   a. endocrine – digestion
   b. digestive – urination
   c. circulatory - respiration
   d. endocrine - sensation

5. People who suffer from diabetes can use the insulin pump device that injects the body automatically with ……………
   a. sugar b. water c. insulin d. carbohydrate

<u>Put (√) or (X):</u>

1- Diabetes disease is one of the disorders of the respiratory system. (   )

2- Pancreas secretes hormone to regulate sugar level in the blood. (   )

3- If pancreas cannot do its function correctly, the sugar level in blood doesn't affect. (   )

4- The body uses sugar to get its needed energy. (   )

5- The insulin pump device helps diabetics control the water level in the blood with automatic injections of insulin. (   )

6- Researchers are working to develop an artificial pancreas instead of the insulin pump device. (   )

Write the scientific term of each of the following:

- The organ that is responsible for regulating the sugar level in blood. (…………………………….)
- A hormone that controls the level of sugar in the human blood. (…………………………………….)
- The system which helps in regulating sugar level in the blood by secreting a specific hormone. (…………………………………………….)
- A device that is used by diabetics to help them control the blood sugar levels with automatic injections of insulin. (……………………………………….)
- A disease that is resulting from the disorder of secreting insulin hormone by pancreas. (………………………………….)

Complete the following sentences using the words below:

(**insulin pump – endocrine - pancreas – blood – diabetes - insulin - energy**)

2) People that have a problem in secreting insulin hormone will be infected by ………………….. disease.
3) Pancreas is one of the organs of …………………… system that produces ………………….. hormone.
4) Insulin regulates the sugar level in the …………………….

5) Diabetics can control the blood sugar levels by using ………………………….. device automatic injects the body with insulin.
6) Researchers are working to develop an artificial ……………. to pump insulin internally inside the human body.
7) The human body uses sugar to get its needed ………………… for doing all vital activities.

<u>Give a reason for :</u>

- Diabetics must give themselves regular shots of insulin.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

<u>What happens if…:</u>

❖ Pancreas doesn't make its function correctly.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Unit 1 – concept 2 - answers

Lesson 1

Choose the correct answer:

1. When you feel nervous, your heartbeats increase, this indicates the interaction between ………………… systems.
   a. digestive and nervous
   b. digestive and circulatory
   c. nervous and circulatory
   d. digestive and respiratory

2. Skeletal system takes nutrients from ………….. system for growth of muscles.
   a. circulatory
   b. digestive
   c. nervous
   d. respiratory

3. When you touch a hot cup of tea, …………………… system sends a message to the muscles of your hand to contract.
   a. respiratory
   b. digestive
   c. circulatory
   d. nervous

4. In a dangerous situation, your eyes send the information to the …………………… to perform the suitable action.
   a. brain
   b. stomach
   c. lungs
   d. heart

5. Muscles of stomach and muscles of heart can be controlled by ……………….. system.
   a. digestive
   b. circulatory
   c. nervous
   d. respiratory

6. The nerve cells depend on ………………….. systems to get their needed nutrients.
   a. digestive and respiratory
   b. digestive and circulatory
   c. circulatory and respiratory
   d. circulatory and nervous

7. The system which transfers nutrients from the digestive system to the different muscles of the body is the ………………… system.
   a. circulatory
   b. nervous
   c. respiratory
   d. excretory

8. In dangerous situations, …………………..
   a. all systems of the body interact together.
   b. circulatory system interacts with digestive system only.
   c. nervous system sends message to digest food in stomach.
   d. respiratory system interacts with circulatory system only.

Put (√) or (x):

1- All systems in your body work together in an integrated way. (√)

2- When you hear a clock alarm, your brain sends a signal to the muscles to move and wake up. (√)

3- In dangerous situations, nervous system only allows your body to face the danger. (X)

4- Digestive system can digest food without the help of nervous system. (X)

5- Muscles of heart are controlled by nervous system. (√)

6- Nutrients reach the nerve cells which found in your hand by the help of circulatory system. (√)

7- Digestive system transfers oxygen gas to all muscles in your body. (X)

Complete the following sentences using the words below:

(body systems – blood – nervous – nutrients – muscles – brain)

1) When you feel nervous, there is an interaction between circulatory system and **nervous** system.
2) When you touch a sharp thorn, your hand moves away quickly due to the interaction between nervous system and **muscles** in your hand.
3) When you smell a fire smoke, the **brain** sends a message to your leg muscles to walk toward the fire location.
4) The interaction between **body systems** is important in any dangerous situation.
5) Digestive system provides the nerve cells with **nutrients** which are needed to perform their functions.
6) Nutrients are transmitted from digestive system to nervous system through the **blood** in the circulatory system.

Give reasons for:

- Digestive system helps skeletal system in fracture healing.
  - **Because digestive system provides the skeletal system with nutrients needed for fracture healing.**
- The nerve cells in the nervous system need nutrients.
  - **To perform their functions.**
- The importance of nervous system for the muscles of heart.
  - **Because nervous system controls the movement of muscles of heart.**

What happens to …:

- The brain of a cyclist when he sees a dangerous situation.
  - **The brain sends a signal to the muscles that contract and allow his body to face the danger.**

Use the following systems to complete the table below:

(you can use the same system more than once)

(Digestive system – Circulatory system – Nervous system)

Description	Name of system
1. It controls the muscles of stomach.	Nervous system
2. It transmits nutrients from digestive system to the nerve cells.	Circulatory system
3. It provides the muscles of heart with its needed food.	Digestive system
4. It controls the muscles of heart.	Nervous system
5. They help in providing and transmitting the nutrients to the muscles of arms.	Digestive system and circulatory system

Lesson 2

Choose the correct answer:

1. Cells differ from each other in ....
   a. shapes only
   b. sizes only
   c. shapes and sizes
   d. neither shapes nor sizes

2. All the following are from the characteristics of muscle cells, except that they ....
   a. Are in the form of long fibers.
   b. can work alone due to their large sizes.
   c. must be able to store and use energy quickly.
   d. can be bundled together to form tissues.

3. The muscle is considered as …………………
   a. a cell   b. a tissue   c. an organ   d. a system

4. Among the organs of musculoskeletal system are ………………….
   a. muscles and bones of arm.
   b. muscles of arm and lungs.
   c. bones and heart.
   d. lungs and heart.

5. Musculoskeletal system allow the body to …………………
   a. digest food.
   b. move from place to another.
   c. transmit nutrients.
   d. exchange oxygen and carbon dioxide.

6. Your leg moves due to contraction and relaxation of …………………. connected to the bon of leg.
   a. hairs   b. toes   c. skin   d. muscles

7. When the muscle in front of the upper arm contracts and the muscle in the back of the upper arm relaxes, the forearm moves ……………………
   a. up towards your shoulder.
   b. down towards your shoulder.
   c. up away from your shoulder.
   d. down away from your shoulder.

8. When the muscles in front of the upper arm relax and the muscles in the back of the upper arm contract, the forearm moves ……………………………….
   a. up towards your shoulder.
   b. down towards your shoulder.

c. up away from your shoulder.

d. down away from your shoulder.

9. The contraction of muscles moves the bones in ………. only.

a. one direction c. four directions

b. two directions d. three directions

10. You can move your fingers due to the contraction and relaxation of the skeletal muscles that attached to the …………………… of your fingers.

a. hairs b. bones c. skin d. nails

11. All the following organs belong to musculoskeletal system, except ………………..

a. tendons b. cartilages c. veins d. bones

Choose from column (B) what suits it in column (A):

(A)		(B)
1. A group of similar cells form	d	a. organs.
2. A group of different tissues form	a	b. cells.
3. A group of different organs form	e	c. whole body.
4. A group of different systems form	c	d. tissues.
		e. systems.

Put (√) or (x):

1- A group of different tissues can form a system. (X)

2- Muscle cells are in the form of long fibers to allow movement. (√)

3- Muscle cells cannot store and use energy quickly. (X)

4- The muscle is formed from bundles of muscle tissues. (√)

5- Musculoskeletal system consists of muscular system and digestive system. (**X**)

6- The body can move by the help of the skeletal system only. (**X**)

7- The forearm moves up towards your shoulder when the muscle in front of the upper arm contracts. (**√**)

8- Contraction and relaxation of leg muscles allow the bones of leg to move. (**√**)

9- Musculoskeletal system consists of muscles and bones only. (**X**)

Write the scientific term of each of the following:

- They are cells in the form of long fibers to allow movement. (**muscle cells**)
- It is the organ which contracts and relaxes to help in the movement of the body. (**muscles**)
- The system which helps the body to move. (**musculoskeletal system**)
- They are muscles that attached to the bones of skeletal system. (**skeletal muscles**)

Complete the following sentences:

1) The body consists of a group of **systems** which consists of a group of organs.
2) Skeletal muscles can store and use **energy** quickly.
3) Bundles of muscle tissues are organized to form the **muscles**.
4) Musculoskeletal system consists of two systems which are and **muscular** system and **skeletal** system that allow the **movement** of the body.
5) When you lift a bag by your hand toward your shoulder, muscles in front of the upper arm **contract** and muscles in the back of the upper arm **relax**.
6) When a muscle contracts, it can exert **force**.

7) When you push a door with your hand, the skeletal muscles that found in your arm work in pairs and move in **opposite** directions.

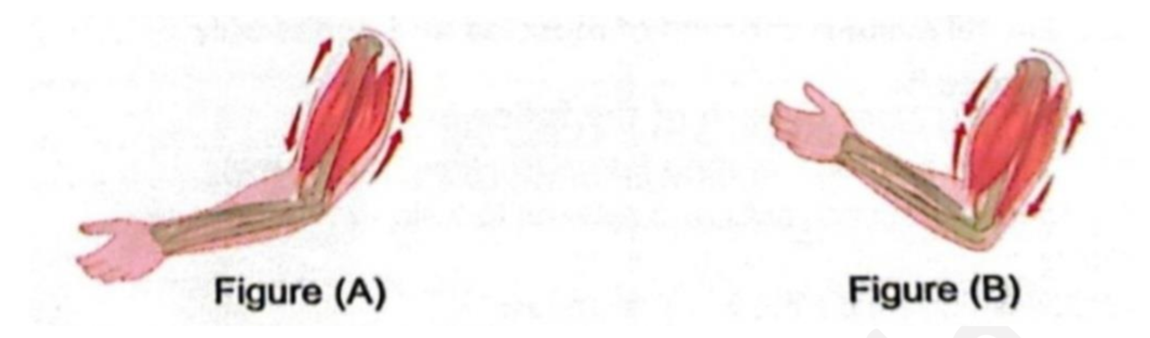
Give reasons for:

- Muscle cells are in the form of long fibers.
    - **To allow the movement.**
- Muscle cells don't work alone.
    - **Because the size of the muscle cell is very small.**
- Skeletal system cannot do the function of movement without muscular system.
    - **Because the skeletal muscles that attached to the bones of skeletal system allow these bones to move.**

What happens to…:

- ❖ Your leg if the muscles found in it are damaged.
    - **The leg cannot move.**
- ❖ The muscles in front of the upper arm and muscles in the back of the upper a when the forearm moves down away from your shoulder.
    - **The muscles in front of the upper arm relax and the muscles in the back of the upper arm contract.**

Look at the following figures, then complete the following sentences:



A) The forearm in figure **B** moves up toward your shoulder.
B) The forearm in figure **A** moves down away from your shoulder.
C) The muscles in front of the upper arm contract in figure **B** and relax in figure **A** .
D) The muscles in the back of the upper arm contract in figure **A** and relax in figure **B**.

Lesson 3

Choose the correct answer:

1. Among the muscles which you cannot control their movement are …………………
   a. hand muscles c. leg muscles
   b. eyelid muscles d. arm muscles

2. Cardiac muscles are type of involuntary muscles which form the …………………
   a. stomach b. intestine c. lungs d. heart

3. Muscles of heart ………………… to pump the blood carrying oxygen to all body cells.
   a. contract only c. contract and relax
   b. relax only d. neither contract nor relax

4. Among the organs which contain both involuntary and voluntary muscles is the ………………..
   a. heart b. arm c. eye d. leg

5. Skeletal muscles work in pairs when …………………
   a. moving your hands towards your shoulder
   b. pumping blood to all the body parts.
   c. transmitting food to all the body parts.
   d. closing your eyelid to allow you blink.

6. The system which helps your body gets ready to respond in different situation: by secreting hormones is the …………… system.
   a. digestive b. endocrine c. circulatory d. nervous

7. Among the functions of endocrine system is ……………………
   a. transmitting food to the nervous system.
   b. controlling the muscles of stomach.
   c. controlling the body temperature and blood pressure.
   d. providing the muscular system with its needed food.

8. All the following are happened by the help of endocrine system to face or to r away from danger, <u>except</u> ………..
   a. contraction of your muscles.
   b. increasing your breathing rate.
   c. increasing your heartbeats.
   d. digestion of food that you eat.

9. All the following are from types of blood vessels, <u>except</u> ……………………
   a. arteries b. heart c. veins d. blood capillaries

10. Circulatory system can transport all the following substances through all the body parts, except ………………
a. nutrients b. gases c. hormones d. bones

11. When you face a dangerous situation, circulatory system do all the following, except …………………
a. your heartbeats increase.
b. muscles of your body relax.
c. heart pumps more blood to the muscles.
d. the blood pressure increases.

12. Among the organs which belong to respiratory system is ……………
a. stomach b. heart c. lung d. brain

13. The system which provides your body with oxygen gas and gets rid of carbon dioxide gas is …………… system.
a. respiratory b. nervous c. endocrine e. circulatory

14. The lungs take in air when the diaphragm …………………, while they release the air when the diaphragm ………….
a. contracts – contracts c. relaxes - relaxes
b. contracts – relaxes d. relaxes - contracts

15. The system which helps the respiratory system in transporting oxygen gas from lungs to all the body organs is the ………… system.
a. digestive b. nervous c. endocrine d. circulatory

16. All the following muscles work in pairs as one muscle contracts, while the other muscle relaxes, except the ………….
a. upper arm muscles c. neck muscles

b. cardiac muscles d. forearm muscles.

Put (√) or (x):

1- Cardiac muscles are considered as voluntary muscles. (X)
2- Heart is made of a type of involuntary muscles known as skeletal muscles. (X)
3- Cardiac muscles contract and relax all the time without stopping. (√)
4- The muscles that help you move your eyes in different directions are considered as voluntary muscles. (√)
5- All skeletal muscles are considered as involuntary muscles and work by contraction. (X)
6- Endocrine system secretes hormones that control the increasing of your breathing rate during danger. (√)
7- The heart begins to beat quickly during normal situations. (X)
8- When the heartbeats increase, the blood pressure increases also. (√)
9- Trachea is the only airway through which oxygen passes to reach the lungs. (X)
10- In dangerous situations, the body sends more oxygenated blood to the muscles and brain to face the danger. (√)
11- Blood transports oxygen gas only to all the body organs and tissues. (X)
12- Forearm muscles are considered as voluntary muscles. (√)

Write the scientific term of each of the following:

- They are muscles that move automatically, and you cannot control their movement. (**involuntary muscles**)
- They are muscles that you can control their movement. (**voluntary muscles**)

- A type of involuntary muscles which form the heart that contract and relax all time without stopping.
  (**cardiac muscles**)
- They are muscles which allow the movement of the bones of skeletal system. (**skeletal muscles**)
- It is the system that secretes hormones to control the body temperature and the blood pressure.
  (**endocrine system**)
- It is the system which consists of the heart and blood vessels that allow blood to flow through the body.
  (**circulatory system**)
- It is the system which consists of lungs and other airways.
  (**respiratory system**)

Complete the following sentences:

1) Muscles of eyelid that allow you blink many times in one minute are considered as **involuntary** muscles, while the muscles that help your eyeball to move in different directions are considered as **voluntary** muscles.
2) The muscles of heart are called **cardiac** muscles and they are considered as a type of **involuntary** muscles.
3) All muscles can do the function of movement by **contraction**.
4) Endocrine system consists of **glands** which secrete **hormones** that control bod temperature and blood **pressure**.
5) In dangerous situations, endocrine system secretes hormones which allow your **muscles** contract and increasing the rate of your **breathing** and **heartbeats**.
6) In dangerous situations, heart pumps more blood which carries **gases**, **nutrients** and **hormones** to the muscles and other organs.
7) The lungs release the air that rich in **carbon dioxide** gas, when the **diaphragm** muscle relaxes.

8) When your heartbeats and breathing rate increase, your body sends more **oxygenated** blood to the muscles and brain to face the danger.
9) Among the skeletal muscles that you can control their movement are upper arm muscles, **neck muscles** and **forearm muscles**.

Give reasons for:

- Cardiac muscles are considered as involuntary muscles.
  - **Because cardiac muscles move automatically which means you cannot control their movement.**
- Cardiac muscles contract and relax without stopping.
  - **To allow the heart pumps the blood carrying oxygen to all body cells.**
- The muscles that surround the eyeball are considered as voluntary muscles.
  - **Because you can control the movement of eyeball muscles.**
- When the body faces a danger, the heartbeats increase.
  - **Because endocrine system secretes hormones which cause increasing of heartbeats rate to face danger.**

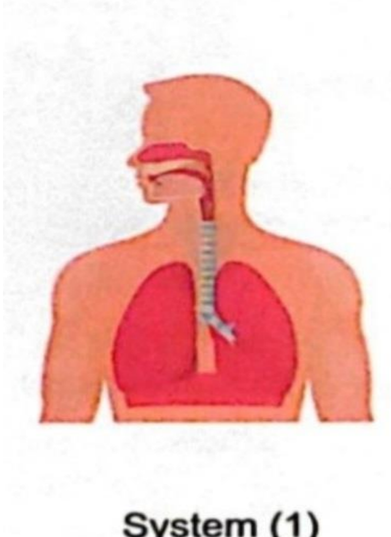
What happens to…:

- The human body if the cardiac muscles don't contract and relax for a long period of time.
  - **The heart cannot pump the blood carrying oxygen to all body cells and the human will die.**
- The human body when the heartbeats increase during danger.

- **The heart pumps more blood to the muscles, the heart and other organs, and also the blood pressure increases.**

❖ The lungs when the diaphragm muscle contracts.
- **The lungs take in the air rich in oxygen gas.**

<u>The following figures show some human body systems, if a person is subjected to an accident while he is riding a bicycle, complete the sentences below:</u>





System (1)



System (2)

A) System number **<u>2</u>** helps endocrine system in carrying hormones to the muscles and brain of the person.
B) Heart that belongs to system number **<u>2</u>** begins to beat quickly.
C) System number **<u>1</u>** contains diaphragm muscle which contracts and relaxes many times to increase the breathing rate.
D) Both system number (1) and (2) help **<u>oxygen</u>** gas to reach muscles and brain of the person.

Lesson 4

Choose the correct answer :

1. The systems of the human body get their needed energy from ....
   a. the sun b. water c. food d. carbon dioxide

2. All the following are from the nutrients that the food contains, except ....
   a. carbohydrates b. oxygen gas c. fats d. proteins

3. The system which converts the complex food into simpler substances that the body can use for energy and growth is the .... system.
   a. respiratory b. nervous c. circulatory d. digestive

4. You can use your .... muscles to help the teeth chew the food.
   a. eye b. cardiac c. jaw d. hand

5. The system which helps the digestive system during chewing the food by secreting enzymes in your mouth is the .... system.
   a. endocrine b. circulatory c. respiratory d. nervous

6. The function of saliva inside your mouth is ....
   a. cutting up the food into smaller parts
   b. softening the food and breaking it down
   c. transporting the food into stomach
   d. transporting the food through body organs.

7. The organ which belongs to the digestive system and secretes fluids contain an acid and some enzymes is the ……………………………..
   a. esophagus b. stomach c. small intestine d. mouth

8. In small intestine, ………………… help(s) in breaking down of food by secreting some enzymes.
   a. pancreas only c. pancreas and gallbladder
   b. gallbladder only d. pancreas and lungs

9. Absorption of nutrients inside the body starts in the ………………. organ.
   a. large intestine c. heart
   b. small intestine d. stomach

10. Walls of small intestine contain ……………………. which responsible for absorbing nutrients of digested food.
   a. blood vessels b. hairs c. glands d. nephrons

11. Blood carries ………………. formed inside small intestine to all the body organs.
   a. feces b. undigested food c. bones d. nutrients

12. The large intestine absorbs ……………. from the undigested food.
   a. nutrients b. water c. blood d. urea

13. The part of large intestine which stores the feces until it leaves the body is the ………………..
   a. rectum b. colon c. esophagus d. anus

14. The organs which can store glucose and convert it into glycogen are ………………….
   a. liver and pancreas c. esophagus and stomach

b. muscles and stomach   d. liver and muscles

15. The system which helps the digestive system in transporting the nutrients to all different body organs is the …………… system.

a. nervous   b. respiratory   c. circulatory   d. excretory

16. The body gets rid of waste materials by ……………. process.

a. digestion   b. excretion   c. respiration   d. sensation

17. The excretion process is necessary to ……….

a. digest the food that you eat.
b. allow your body to move.
c. transport the nutrients inside your body.
d. remove the waste products from your body.

18. All the following are responsible for excretion process, except …………….

a. digestive system   c. respiratory system
b. skin   d. urinary system

19. The organ which is responsible for secreting sweat is the …………

a. esophagus   b. stomach   c. skin   d. kidney

20. All the following are from the waste materials which are produced by your body, <u>except</u> ………….

a. urine   b. oxygen gas   c. carbon dioxide   d. sweat

21. Among the organs which belong to urinary system are ……….

a. stomach and kidneys   c. kidneys and bladder
b. ureters and gallbladder   d. urethra and heart

22. The two kidneys play an important role in the filtration of .... inside your body.

a. water b. enzyme c. acid **d. blood**

23. The blood which carries the waste materials, enters each kidney through a large ....

a. vein **b. artery** c. blood capillary d. ureter

24. Urea is formed due to the breaking down of .... inside the body cells.

a. Carbohydrates b. fats c. acids **d. proteins**

25. The tube which transports the urine from the kidney to the bladder is the ....

a. vein b. urethra **c. ureter** d. artery

26. The process of expelling urine from the body is called .... process.

a. urination b. respiration c. digestion d. sensation

Put (√) or (x):

1- Systems get their needed energy from the food we eat. (√)

2- The simple substances must be converted into complex nutrients to be used by the body cells. (X)

3- Digestion begins when the food enters esophagus. (X)

4- Saliva is a liquid which is secreted by endocrine system inside your mouth. (√)

5- The acid and enzymes which are secreted inside stomach lead to more breaking down of food. (√)

6- Inside large intestine, enzymes which are secreted from pancreas and gallbladder help in the chemical breakdown of food. (X)

7- Absorption of digested food starts in the small intestine.

(√)

8- The digested food enters the colon as a soupy mixture. (X)

9- Colon absorbs most of water from the undigested food that leaves the body. (√)

10- The feces leave the body through a bony opening known as anus. (X)

11- Circulatory system transports the digested food to different body organs. (√)

12- All nutrients that are absorbed from small intestine are stored as fats inside the body. (X)

13- Glycogen is converted into glucose and stored in liver and muscles. (X)

14- When your body needs energy, liver and muscles convert glycogen into glucose again. (√)

15- Excretion process is necessary to convert complex food into simpler substances. (X)

16- If your body doesn't get rid of waste, you will be healthy. (X)

17- The main waste product which is expelled by respiratory system is the urea. (X)

18- The two kidneys remove waste materials from the blood. (√)

19- Nephron helps in the filtration of blood from urea. (√)

20- Urine is expelled outside the body through urethra. (√)

21- Blood cells and proteins are too small, so they can pass through the nephrons of kidneys. (X)

Write the scientific term of each of the following:

- The system which converts the complex food into simpler substances that the body can use to get energy.
(**digestive system**)

- The process of breaking down the complex food into simpler substances. (**digestion process**)
- A liquid in your mouth contains an enzyme which helps in digestion process. (**saliva**)
- An organ in which absorption of nutrients starts. (**small intestine**)
- The organ which absorbs most of water from the undigested food. (**large intestine**)
- The last part of large intestine that stores the feces until it leaves the body. (**rectum**)
- A substance that is stored in liver and muscles, then converted into glucose when your body needs energy. (**glycogen**)
- It is a system that is responsible for storing and getting rid of waste materials produced from cells. (**excretory system**)
- It is the process of removing the waste products resulting from burning food inside the body cells through their membranes. (**excretion process**)
- The organ which helps in excretion of sweat through the pores that are found in it. (**skin**)
- The system that is responsible for excretion of carbon dioxide gas. (**respiratory system**)
- It is a microscopic filter that is found in the two kidneys and filters the blood from waste materials. (**nephron**)
- A substance which is formed due to the breakdown of proteins inside the body cells. (**urea**)
- It is the process of expelling urine from the body. (**urination process**)

Complete the following sentences:

1) The food we eat contains different nutrients such as **carbohydrates** , **fats** and **proteins**.

2) Your body cells can use simple substances that are converted from complex **food** to get their needed **energy** to do their functions.
3) The system which helps your teeth and jaw move to chew the food is the **muscular (musculoskeletal)** system.
4) Stomach contains an **acid** and some **enzymes** that lead to more food breakdown.
5) Inside small intestine, **pancreas** and **gallbladder** secrete enzymes to help in the chemical breakdown of food.
6) After completing the digestion of food, the walls of **small intestine** absorb the nutrients through **blood vessels** that carry them to all the body parts.
7) Undigested food passes to **large** intestine which absorbs most of **water** from it, leaving the solid waste that is known as **feces** or **stool**.
8) The muscular opening that the feces passes through it to outside the body is known as **anus**.
9) Cells can use **glucose** sugar at once to get their needed energy, and this sugar can be converted into **glycogen** and stored in liver and **muscles**.
10) Excretion process happens when **excretory** system collects the waste materials produced by **cells** and expels them outside the body.
11) Some waste products leave your body in the form of **sweat** through your skin.
12) Respiratory system removes **carbon dioxide** gas from the body as a waste product.
13) Urinary system removes waste material from the blood in the form of **urine**.
14) Blood which carries waste materials reach the kidney through a large **artery**.
15) Filtration of blood occurs inside the **kidneys** by the help of a microscopic filter known as **nephron**.
16) When you eat a piece of meat, proteins are broken down and form a waste material known as **urea**.

17) Urine is composed of **urea**, other waste products and **water**.
18) Urine leaves each kidney through **ureter** and is collected in the **bladder** until it is expelled outside the body.
19) Blood cells and **proteins** are **large** in size, so they cannot pass through nephrons, and stay in the body.

Give reasons for:

- The body needs to convert complex food into simpler substance.
  - **Because the body cells use this simpler substance to get energy and grow.**

- Saliva plays an important role in digestion of food inside the mouth.
  - **Because saliva can easily soften the food and starts the chemical breakdown of food.**

- Stomach secretes a digestive fluid when the food reach it.
  - **To allow more food breakdown.**

- Walls of small intestine contain blood vessels.
  - **To carry the digested food (nutrients) to all body parts after completing digestion process.**

- Undigested food becomes solid wastes inside the large intestine.
  - **Because large intestine (colon) absorbs most of water from the undigested food.**

- The liver and muscles convert the stored glycogen into glucose sugar.
  - **To provide the body with its needed energy.**

- Importance of excretion process to your body.
    - **Because the excretory system collects the waste materials produced by cells and remove them from the body to keep the body healthy.**
- The digestive system doesn't share in excretion process.
    - **Because it doesn't work on the waste materials produced from burning food inside the body cells.**
- The two kidneys contain many nephrons.
    - **To filter the blood and remove harmful substances from the body.**
- Formation of urea inside the body of human.
    - **Due to the breakdown of proteins inside the body cells.**

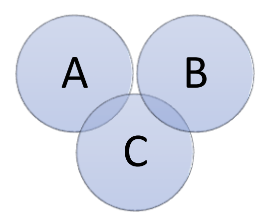
What happens if…:

- Complex nutrients don't convert into simple substances inside your body.
    - **They cannot be used by body cells to get energy to grow.**
- Saliva is not secreted during chewing the food inside your mouth.
    - **The food cannot be easily softened and chemical breakdown of food will not happen.**
- Pancreas and gallbladder don't secrete their enzymes in small intestine.
    - **The chemical breakdown of food will not happen.**
- Your body doesn't get rid of waste.
    - **The body will get sick.**

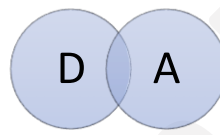
❖ The blood that carries waste materials passes through nephrons of the two kidneys.
  - **The blood will be filtered from harmful substances.**

Look at the following diagrams that represent the sharing of some body systems to do some processes, then use the words below to complete the following sentences:

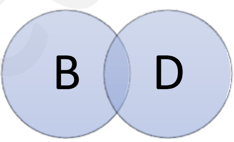
(**respiratory system – skin - urinary system - circulatory system**)



Excretion process



Transportation of waste materials and urination process



Respiration process and transportation of gases

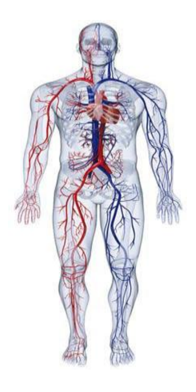
1. Letter (A) represents **urinary system**.
2. Letter (B) represents **respiratory system**.
3. Letter © represents **skin**.
4. Letter (D) represents **circulatory system**.

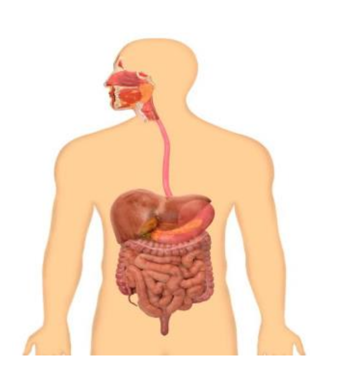
Write each of the following organs below the system that belongs to:

(**Heart - Lungs - Kidneys – Stomach**)











Heart

Stomach

Lungs

Lesson 5

Choose the correct answer :

1. Engineers design special devices to work instead of ……………………. organ which filter the blood from waste materials.
   a. stomach   b. heart   c. kidney   d. lung

2. Nephrons play an important role in …………………..
   a. secreting hormones to control the body functions.
   b. controlling the movement of body from place to another.
   c. breaking down the complex food into simple nutrients.
   d. filtering the blood from waste materials.

3. Among the substances which cannot pass through the kidneys' nephrons are ……………………..
   a. blood cells and urea
   b. blood cells and proteins
   c. proteins and urea
   d. water and urea

4. Urination process happens by the help of ………………… system.
   a. digestive   b. urinary   c. respiratory   d. skeletal

5. The two kidneys remove waste materials as ……………….., and expel them in the form of urine.
   a. water and urea
   b. urea and blood cells
   c. water and proteins
   d. proteins and blood cells

Put (√) or (x):

1- Kidneys are considered as a filtering system for the blood. (√)
2- People whose kidneys are not working properly must use other devices to filter their blood from waste. (√)
3- Proteins can pass through nephrons during filtration of blood in the two kidneys. (X)
4- Studying a kidney model can save time, money and effort. (√)
5- The two kidneys remove waste materials from undigested food which come out in the form of urine. (X)

Complete the following sentences using the words below:

(**kidney model - proteins – blood - urine - nephrons – urea**)

1) People whose kidneys are not working well, their **blood** cannot be filtered well.
2) Some substances can pass through nephrons as **urea** while other substances cannot pass through nephrons as **proteins**.
3) The microscopic filters which are found inside the two kidneys are called **nephrons**.
4) We can save people's life when studying a **kidney model** instead of a real kidney.
5) Waste materials that are removed by the help of urinary system are coming in the form of **urine**.

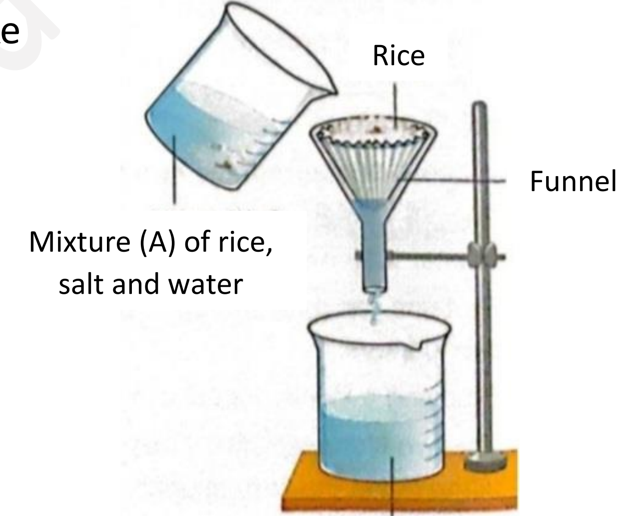
Give a reason for :

- Blood cells and proteins cannot pass through the kidney's nephrons.
  - **Because they are too large.**

What happens if...:

- The blood does not pass through the two kidneys during its circulation inside the human body.
  - **The blood will not be filtered from the waste materials and the body will get sick.**

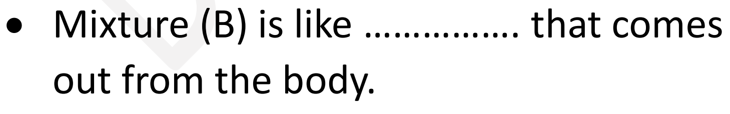
Look at the opposite figure, then choose the correct answer from those between brackets:



- The filter in the opposite figure is like ………. organ in the urinary system.
  (stomach – **kidney**)

- Mixture (A) is like ……….. which is found in the body.
  (**blood before filtering** - blood after filtering)

- Mixture (B) is like ……………. that comes out from the body.
  (filtered blood - **urine**)



- Rice in the opposite figure is like ………. which cannot pass through nephrons during filtration of blood.
  (**proteins** – urea)

Lesson 6

Choose the correct answer:

1. Diabetes disease occurs due to a disturbance in one organ of ………………… system.
   a. respiratory b. nervous **c. endocrine** d. urinary

2. The organ which is responsible for secreting insulin hormone is the …………………
   a. gallbladder **b. pancreas** c. liver d. stomach

3. Insulin hormone is responsible for regulating the level of ……………………… in blood.
   a. proteins b. fats c. water **d. sugar**

4. Pancreas belongs to ……………. system and its secretions help in completing ………………………. process.
   a. endocrine – digestion c. circulatory - respiration
   b. digestive – urination d. endocrine - sensation

5. People who suffer from diabetes can use the insulin pump device that injects the body automatically with ……………
   a. sugar b. water **c. insulin** d. carbohydrate

Put (√) or (X):

1- Diabetes disease is one of the disorders of the respiratory system. (X)
2- Pancreas secretes hormone to regulate sugar level in the blood. (√)
3- If pancreas cannot do its function correctly, the sugar level in blood doesn't affect. (X)
4- The body uses sugar to get its needed energy. (√)

5- The insulin pump device helps diabetics control the water level in the blood with automatic injections of insulin. (X)

6- Researchers are working to develop an artificial pancreas instead of the insulin pump device. (√)

Write the scientific term of each of the following:

- The organ that is responsible for regulating the sugar level in blood. (**pancreas**)
- A hormone that controls the level of sugar in the human blood. (**insulin hormone**)
- The system which helps in regulating sugar level in the blood by secreting a specific hormone. (**endocrine system**)
- A device that is used by diabetics to help them control the blood sugar levels with automatic injections of insulin. (**insulin pump**)
- A disease that is resulting from the disorder of secreting insulin hormone by pancreas. (**diabetes**)

Complete the following sentences using the words below:

(**insulin pump – endocrine - pancreas – blood – diabetes - insulin - energy**)

1) People that have a problem in secreting insulin hormone will be infected by **diabetes** disease.
2) Pancreas is one of the organs of **endocrine** system that produces **insulin** hormone.
3) Insulin regulates the sugar level in the **blood**.
4) Diabetics can control the blood sugar levels by using **insulin pump** device automatic injects the body with insulin.

5) Researchers are working to develop an artificial **pancreas** to pump insulin internally inside the human body.
6) The human body uses sugar to get its needed **energy** for doing all vital activities.

Give a reason for :

- Diabetics must give themselves regular shots of insulin.
  - **To regulate the level of sugar in the blood.**

What happens if...:

- Pancreas doesn't make its function correctly.
  - **The person will be infected with diabetes disease.**

Unit 1 – concept 3
{ Energy as a system }



From the previous pictures, we can notice that:



- **In picture (1)** , behind the wall, there are many wires leading to electrical outlets and light fixtures that conduct the electricity to all parts in the house.



- **In picture (2)** , electric energy transfers to the device that are powered by electricity through wires.

ومن الصور السابقة نلاحظ ما يلي:

- **في الصورة (1)** ، يوجد خلف الجدار العديد من الأسلاك التي تؤدي إلى منافذ الكهرباء وأجهزة الإضاءة التي توصل الكهرباء إلى جميع أجزاء المنزل.
- **في الصورة (2)** ، تنتقل الطاقة الكهربائية إلى الجهاز الذي يتم تغذيته بالكهرباء عبر الأسلاك.

Example of electric circuits:

- Electrical poles that support electric wires between cities and the wires inside walls are all examples of electric circuits.



Electrical poles
الأعمدة الكهربائية

- So, every time you turn on a light switch or an electrical device, you use electric circuits.

How is a circuit considered as a system?

- The electric circuit is a path for electricity that consists of many components that work together as one system.

أمثلة على الدوائر الكهربائية:

- الأعمدة الكهربائية التي تدعم الأسلاك الكهربائية بين المدن والأسلاك داخل الجدران كلها أمثلة على الدوائر الكهربائية.
- لذلك، في كل مرة تقوم فيها بتشغيل مفتاح الضوء أو جهاز كهربائي، فإنك تستخدم الدوائر الكهربائية.

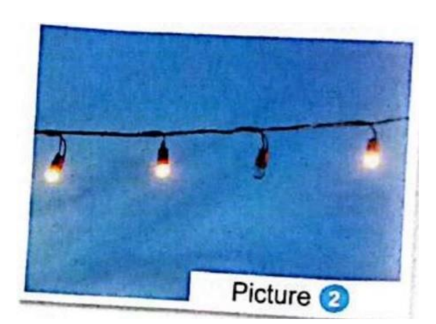
كيف تعتبر الدائرة كنظام؟

- الدائرة الكهربائية عبارة عن مسار للكهرباء يتكون من العديد من المكونات التي تعمل معًا كنظام واحد.

Light bulb trouble

- ***In the two following pictures, only one light bulb has burned out, this burned out light bulb has affected each strand of lights differently, where :***


Picture 1


Picture 2

In picture (1): When a light bulb burns out, all the other light bulbs are turned off because they are connected together in a way known as "***series way***"

In picture (2):

When a light bulb burns out, all the other light bulbs still light because they are connected together in a way known as "***parallel way***"

From the previous explanation, we can conclude that:

- There are different ways to connect the components of an electric circuit.

مشكلة المصباح الكهربائي:

- في الصورتين التاليتين، تم احتراق مصباح واحد فقط، وقد أثر هذا المصباح المحترق على كل شريط من المصابيح بشكل مختلف، حيث:

في الصورة (1):

عندما يحترق أحد المصابيح الكهربائية، تنطفئ جميع المصابيح الكهربائية الأخرى لأنها متصلة ببعضها البعض بطريقة تعرف باسم "***الطريقة المتسلسلة***"

في الصورة (2):

عندما يحترق مصباح كهربائي، تظل جميع المصابيح الكهربائية الأخرى مضاءة لأنها متصلة ببعضها البعض بطريقة تعرف باسم "***الطريقة المتوازية***"

ومن الشرح السابق نستنتج أن:

- هناك طرق مختلفة لتوصيل مكونات الدائرة الكهربائية.

Magnetism and Gravity

- Gravity and magnetism are forces that affect us every day.
- The two forces are different from the other forces ***because objects do not have to come into contact with one another to get affected by gravity or magnetism***.

المغناطيسية والجاذبية

- الجاذبية والمغناطيسية قوى تؤثر علينا كل يوم.
- تختلف القوتان عن القوى الأخرى ***لأنه ليس من الضروري أن تتلامس الأجسام مع بعضها البعض لتتأثر بالجاذبية أو المغناطيسية***.

How gravity and magnetism are similar:

Gravity at work

- Gravity (***gravitational force***) is a force that affects everything which has mass.
- Earth has great mass compared to everything located on its surface, so all objects on or near Earth's surface are pulled toward its center.

- There are two factors that affect the force of gravity:
  - **Distance** 2. **Mass**

As the distance between objects and the center of the Earth **increases**, the gravitational force **decreases**.

- ***We cannot see gravity***, but we can observe its effect on objects such as:
  - Gravity holds you to the ground.
  - When you throw a ball into the air, it will stop moving upward at a certain point and fall back to Earth, this is due gravity.



كيف تتشابه الجاذبية والمغناطيسية:

الجاذبية في العمل:

- الجاذبية (***قوة الجاذبية***) هي القوة التي تؤثر على كل ما له كتلة.
- تتمتع الأرض بكتلة كبيرة مقارنة بكل شيء موجود على سطحها، لذلك يتم سحب جميع الأجسام الموجودة على سطح الأرض أو بالقرب منه نحو مركزها.
- هناك عاملان يؤثران على قوة الجاذبية:

1. **المسافة** 2. **الكتلة**

كلما **زادت** المسافة بين الأجسام ومركز الأرض، **تقل** قوة الجاذبية.

- لا نستطيع رؤية الجاذبية، ولكن يمكننا ملاحظة تأثيرها على الأجسام مثل:
  - الجاذبية تحملك على الأرض.
  - عندما ترمي كرة في الهواء، ستتوقف عن التحرك للأعلى عند نقطة معينة وتعود إلى الأرض، وهذا بسبب الجاذبية.

Magnetism at work

- Magnets are made of iron and other materials.
- A magnet has a force called "**magnetism**".
  - Magnetism allows the magnet to attract certain materials without making direct contact.
  - Magnetism allows magnets to attract or repel other magnets.

Magnetic field

Magnetism of a magnet appears in an area around it known as "**magnetic field**"

Magnetism affects certain objects that are in its magnetic field.

المغناطيسية في العمل:

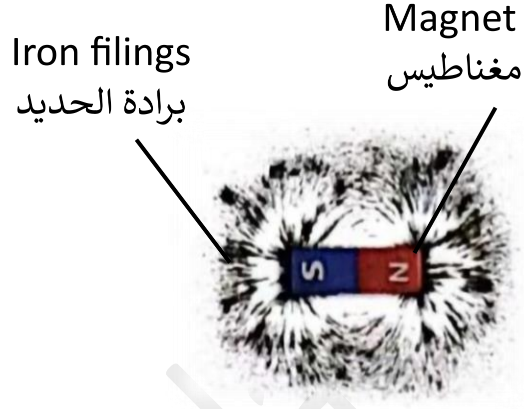
- المغناطيس يصنع من الحديد ومواد أخرى.
- للمغناطيس قوة تسمى "**المغناطيسية**".
  - المغناطيسية تسمح للمغناطيس بجذب مواد معينة دون الاتصال المباشر.
  - المغناطيسية تسمح للمغناطيس بجذب أو صد المغناطيسات الأخرى.

المجال المغناطيسي:

تظهر مغناطيسية المغناطيس في منطقة حوله تعرف باسم "**المجال المغناطيسي**".

تؤثر المغناطيسية على بعض الأجسام الموجودة في مجالها المغناطيسي.

- Like gravity, ***we cannot see the magnetic field***, but we can only observe its effects.
  - The best way to see the magnetic field is to allow a magnet to attract some iron filings.
  - The pattern that the iron filings make near the magnet is the outline of its magnetic field as shown in the opposite picture.



- مثل الجاذبية، **لا يمكننا رؤية المجال المغناطيسي**، ولكن يمكننا فقط ملاحظة آثاره.
  - أفضل طريقة لرؤية المجال المغناطيسي هي السماح للمغناطيس بجذب بعض برادة الحديد.
  - والنمط الذي تصنعه برادة الحديد بالقرب من المغناطيس هو الخطوط العريضة لمجالها المغناطيسي كما هو موضح في الصورة المقابلة.

Similarities and differences between gravity and magnetism:

Gravity	Magnetism
Similarities	
1. Both of them are forces. 2. It is not necessary for objects to come into contact with one another to get affected by gravity and magnetism.	
Differences	
- Gravity attracts any object that has mass. - Gravity is always downward pulling force.	- Magnetism attracts certain materials only. - Magnetism is considered as:

	• A pulling force when it attracts objects or another magnet. • A pushing force when it repels another magnet.

أوجه التشابه والاختلاف بين الجاذبية والمغناطيسية:

الجاذبية	المغناطيسية

التشابه

1. كلاهما قوى.
2. ليس من الضروري أن تتلامس الأجسام مع بعضها البعض لتتأثر بالجاذبية والمغناطيسية.

الاختلافات

الجاذبية	المغناطيسية
▪ الجاذبية تجذب أي جسم له كتلة.	▪ تجذب المغناطيسية مواد معينة فقط.
▪ الجاذبية هي دائمًا قوة سحب للأسفل.	▪ تعتبر المغناطيسية على النحو التالي: - قوة جذب عندما يجذب أشياء أو مغناطيس آخر. - قوة دفع عندما تصد مغناطيسا آخر.

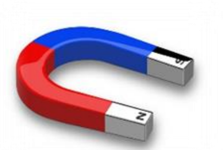
Lesson 2

Does it attract?

- In this activity, we will test materials to determine what objects are attracted to magnets and also how the distance between the magnet and an object affect the attraction between them.

في هذا النشاط، سنقوم باختبار المواد لتحديد الأشياء التي تنجذب إلى المغناطيس وأيضًا كيفية تأثير المسافة بين المغناطيس والجسم على الجذب بينهما.

Tools:



Magnet
مغناطيس



Ruler
مسطرة



Iron nail
مسمار حديد



Aluminum foil
ورق الفويل



Plastic spoon
ملعقة بلاستيكية



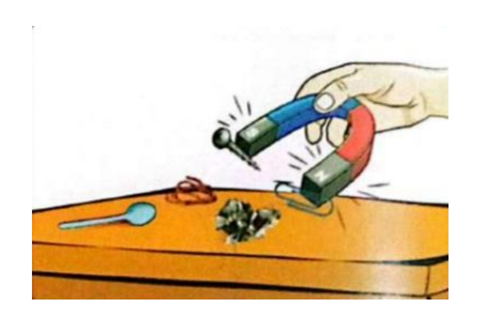
Copper wire
سلك نحاس



Steel paper clip
(steel is a special type of iron)
مشبك ورق حديدي
(الفولاذ هو نوع خاص من الحديد)

Steps:

1. Put the magnet near each item to determine whether its material is magnetic or non-magnetic.



الخطوات:

1. ضع المغناطيس بالقرب من كل قطعة لتحديد ما إذا كانت مادتها مغناطيسية أم غير مغناطيسية.



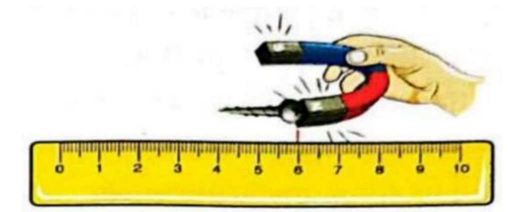
Observations:

- The iron nail and the steel paper clip are attracted to the magnet.
- The aluminum foil, the plastic spoon and the copper wire are not attracted to the magnet.
  - ينجذب المسمار الحديدي ومشبك الورق الفولاذي إلى المغناطيس.
  - لا تنجذب رقائق الألومنيوم والملعقة البلاستيكية والسلك النحاسي إلى المغناطيس.

2. Put the iron nail at the 0 cm of the ruler and put the magnet at the other end of the ruler.



3. Approach the magnet slowly closer to the iron nail.



2. ضع المسمار الحديدي عند 0 سم من المسطرة ثم ضع المغناطيس في الطرف الآخر من المسطرة.
3. اقترب من المغناطيس ببطء بالقرب من المسمار الحديدي.



Observation:

- The magnet attracts the iron nail at the distance of 6 cm.

يجذب المغناطيس المسمار الحديدي مسافة 6 سم.

Conclusions:

1. Magnets attract some metals only, such as **iron (steel)**, **nickel** and **cobalt**.
2. The magnetic objects are attracted to the magnet from far distance when these objects locate at the magnetic field of the magnet.

Magnetic materials	**Non-magnetic materials**
They are materials that are attracted to the magnet. ***Examples:*** • Iron, nickel and cobalt.	They are materials that are not attracted to the magnet. ***Examples:*** • Aluminum, plastic, copper, paper and wood.

الاستنتاجات:

1. يجذب المغناطيس بعض المعادن فقط مثل الحديد (الصلب) والنيكل والكوبالت.
2. تنجذب الأجسام المغناطيسية إلى المغناطيس من مسافة بعيدة عندما تقع هذه الأجسام في المجال المغناطيسي للمغناطيس.

المواد المغناطيسية

- إنها المواد التي تنجذب إلى المغناطيس.

أمثلة:

- الحديد والنيكل والكوبالت.

المواد غير المغناطيسية

- هي مواد لا تنجذب للمغناطيس.

أمثلة:

- الألومنيوم والبلاستيك والنحاس والورق والخشب.



Generating electricity

In this activity, we will study the generator which is a device used in generating electricity.

Generator:



Structure:

It consists of:

- Large magnets.
- Coiled wires

Function: It changes **mechanical energy (kinetic energy)** into **electrical energy** used in lighting houses and operating electrical devices.

في هذا النشاط سوف نقوم بدراسة المولد وهو جهاز يستخدم في توليد الكهرباء.

مولد الكهرباء:

التركيب:

يتكون من: - مغناطيس كبير. – أسلاك ملفوفة.

الوظيفة: تقوم بتحويل **الطاقة الميكانيكية (الطاقة الحركية)** إلى **طاقة كهربائية** تستخدم في إنارة المنازل وتشغيل الأجهزة الكهربائية.

How does a generator work?

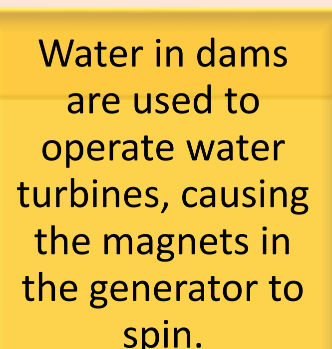
- When large magnets spin at a high speed, the spinning magnets create electrical charges on the coiled wires, so electricity is produced.

There are different forces that can be used to make the magnets in the generator spin to generate electricity, such as:









Water in dams are used to operate water turbines, causing the magnets in the generator to spin.

Winds are used to operate wind turbines, causing the magnets in the generator to spin.

Sources of fuel such as oil and coal are used to make water boil producing steam which causes the magnet in the generator to spin.

كيف يعمل المولد؟

- عندما تدور مغناطيسات كبيرة بسرعة عالية، فإن المغناطيسات الدوارة تولد شحنات كهربائية على الأسلاك الملتفة، وبالتالي يتم إنتاج الكهرباء.

هناك قوى مختلفة يمكن استخدامها لجعل المغناطيس الموجود في المولد يدور لتوليد الكهرباء، مثل:

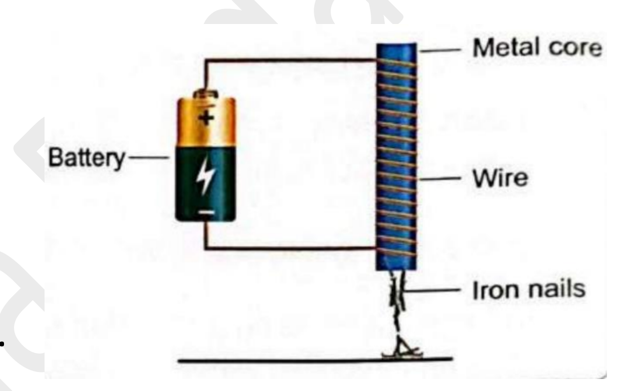
- تُستخدم المياه الموجودة في السدود لتشغيل توربينات المياه، مما يتسبب في دوران المغناطيس الموجود في المولد.
- تستخدم الرياح لتشغيل توربينات الرياح، مما يؤدي إلى دوران المغناطيس الموجود في المولد.
- تُستخدم مصادر الوقود مثل النفط والفحم لغلي الماء وإنتاج البخار الذي يتسبب في دوران المغناطيس الموجود في المولد.

You already know some information about electricity (electrical energy) and magnetism (magnetic energy).

- The flow of electricity through wires is known as "***electric current***".
- The electric current comes from the movement of tiny, charged particles through conducting wires.

- When an electric current flows through a wire, it forms a magnetic effect around the wire known as "***magnetic field***".

  - If a wire wrapped around a metal core, the magnetic field produced by the flowing current is strengthened, so the metal core attracts the iron nails as in the opposite picture.



From the previous explanation, we can conclude that:

- Electricity and magnetism can work together.

أنت تعرف بالفعل بعض المعلومات عن الكهرباء (الطاقة الكهربائية) والمغناطيسية (الطاقة المغناطيسية).

- يُعرف تدفق الكهرباء عبر الأسلاك باسم "**التيار الكهربائي**".
- يأتي التيار الكهربائي من حركة الجزيئات الصغيرة المشحونة عبر الأسلاك الموصلة.
- عندما يتدفق تيار كهربائي عبر سلك، فإنه يشكل تأثيراً مغناطيسياً حول السلك يعرف باسم "**المجال المغناطيسي**".
  - إذا كان السلك ملفوفاً حول قلب معدني فإن المجال المغناطيسي الناتج عن التيار المتدفق يقوى، وبالتالي فإن القلب المعدني يجذب المسامير الحديدية كما في الصورة المقابلة.

من الشرح السابق نستنتج أن:

- يمكن أن تعمل الكهرباء والمغناطيسية معًا.

Components of a Circuit

- magnets, generators and turbines can be used to generate electricity.

مكونات الدائرة

يمكن استخدام المغناطيس والمولدات والتوربينات لتوليد الكهرباء.

Electricity:

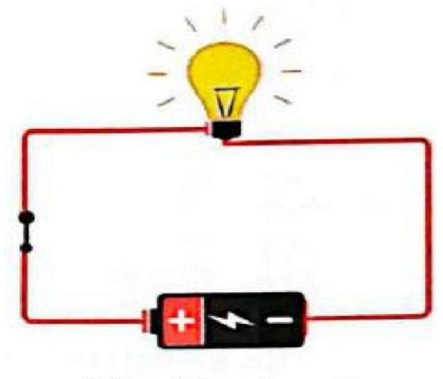
- It is a form of energy that comes from a flow of electric charges moving along a path, these charges called "**electrons**".
- In order to do work, electrons must flow in a steady stream, which is known as an "**electric current**".

> ***Electric current:***
> It is the flow of electric charges along a closed path.

Electric circuit:

> ***Electric circuit:***
> It is a path for transmitting an electric current.

- To make the electric current flow through a circuit, the loop (circuit) must be closed, this means that it must begin and end in the same place without any breaks in the loop.



Electric circuit

- In the electric circuit, there must be a source of electricity, this source could be:

A battery







- Wall socket is a source of electricity that transfers electric current from power lines connected to the building.

الكهرباء:

- إنها شكل من أشكال الطاقة التي تأتي من تدفق الشحنات الكهربائية التي تتحرك على طول المسار، وتسمى هذه الشحنات "**الإلكترونات**".
- من أجل القيام بالعمل، يجب أن تتدفق الإلكترونات في تيار مستمر، وهو ما يعرف باسم "**التيار الكهربائي**".

التيار الكهربائي :

هو تدفق الشحنات الكهربائية على طول مسار مغلق.

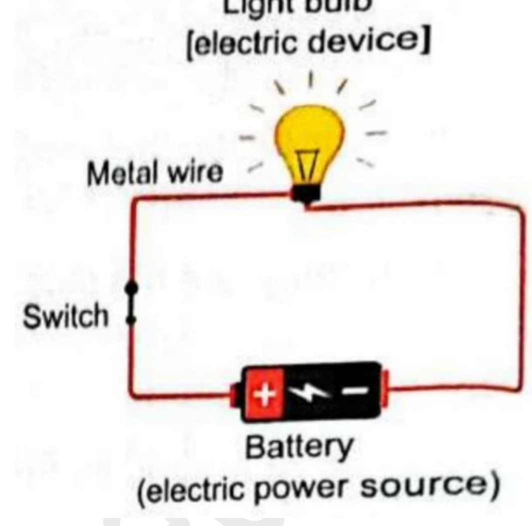
الدائرة الكهربائية:

الدائرة الكهربائية:

إنه طريق لنقل التيار الكهربائي.

- لكي يتدفق التيار الكهربائي خلال الدائرة، يجب أن تكون الحلقة (الدائرة) مغلقة، أي أنها يجب أن تبدأ وتنتهي في نفس المكان دون أي انقطاع في الحلقة.
- في الدائرة الكهربائية لا بد من وجود مصدر للكهرباء، وهذا المصدر يمكن أن يكون: البطارية أو مقبس الحائط
- مقبس الحائط هو مصدر للكهرباء ينقل التيار الكهربائي من خطوط الكهرباء المتصلة بالمبنى.

- Most electric circuits consist of many components that conduct electricity, which are:
  - A metal wire.
  - An electric power source.
  - A switch.
  - An electric device.



Closed electric circuit

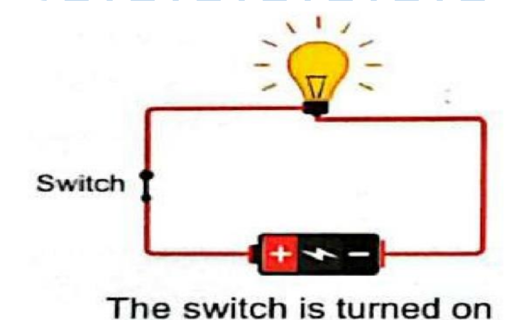
- تتكون معظم الدوائر الكهربائية من العديد من المكونات الموصلة للكهرباء، وهي:
  - سلك معدني .
  - مصدر للطاقة الكهربائية.
  - محول مفتاح.
  - جهاز كهربائي .

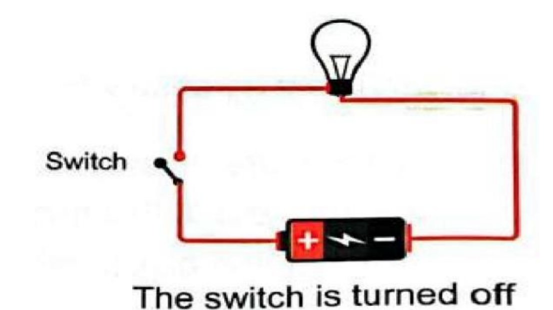
The switch:

- A switch is the most common tool to open and close the electric circuit.
- A switch can be ***manual*** such as a wall switch for lights, where:

When the switch is closed (turned on), it closes the circuit (closed electric circuit), so the electric current flows through the circuit.

When the switch is opened (turned off), it opens the circuit (opened electric circuit), so the electric current doesn't flow through the circuit.





- A switch can be ***automatic*** such as the internal switch on a **thermostat**, which adjusts the temperature inside devices such as the refrigerator.

المفتاح:

- المفتاح هو الأداة الأكثر شيوعًا لفتح وإغلاق الدائرة الكهربائية.
- يمكن أن يكون المفتاح ***يدويًا*** مثل مفتاح الجدار للأضواء، حيث:
  - عند إغلاق المفتاح (تشغيله) فإنه يغلق الدائرة (دائرة كهربائية مغلقة فيتدفق التيار الكهربائي خلال الدائرة.
  - عند فتح المفتاح (مطفأ)، فإنه يفتح الدائرة (دائرة كهربائية مفتوحة)، وبالتالي لا يتدفق التيار الكهربائي عبر الدائرة.
- يمكن أن يكون المفتاح ***تلقائيًا*** مثل المفتاح الداخلي الموجود في منظم الحرارة، والذي يضبط درجة الحرارة داخل الأجهزة مثل الثلاجة.

Electric conductors and insulators

Electric conductors:

They are materials through which electric current (electrons) flows easily.

- Electric conductors also known as "***good conductors of electricity***."

Examples of good conductors of electricity:

- All metals such as copper and aluminum.
- Water.

Electric insulators:

They are materials through which electric current (electrons) does not flow easily.

- Electric insulators also known as "***bad conductors of electricity***".

Examples of bad conductors of electricity:

- Rubber.
- Plastic.

الموصلات الكهربائية والعوازل:

الموصلات الكهربائية:

وهي مواد يتدفق من خلالها التيار الكهربائي (الإلكترونات) بسهولة.

- الموصلات الكهربائية والمعروفة أيضًا باسم "**الموصلات الجيدة للكهرباء**".

أمثلة على الموصلات الجيدة للكهرباء:

- جميع المعادن مثل النحاس والألومنيوم. - الماء.

العوازل الكهربائية:

وهي مواد لا يتدفق من خلالها التيار الكهربائي (الإلكترونات) بسهولة.

- العوازل الكهربائية والمعروفة أيضاً باسم "***الموصلات السيئة للكهرباء***".

أمثلة على الموصلات السيئة للكهرباء:

- المطاط - البلاستيك

Current safety

- Most electric wires are coated with rubber or plastic which are bad conductors of electricity, to protect people from electric shock.

- Touching non insulated wire that an electric current flows through causes an electric shock and may cause death, because the human body contains a lot of water which is good conductor of electricity.



السلامة الحالية:

- معظم الأسلاك الكهربائية مطلية بالمطاط أو البلاستيك وهي موصلات سيئة للكهرباء، وذلك لحماية الأشخاص من الصدمات الكهربائية.
- إن لمس سلك غير معزول يمر عبره تيار كهربائي يسبب صدمة كهربائية وقد يؤدي إلى الوفاة، وذلك لأن جسم الإنسان يحتوي على كمية كبيرة من الماء وهو موصل جيد للكهرباء.



Conductors and insulators

In this activity, we will know which materials are electric conductors and which are electric insulators.

في هذا النشاط، سوف نعرف أي المواد موصّلة للكهرباء وأيها عازلة للكهرباء.

Tools:


Battery
بطارية

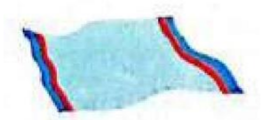

Small LED lamp
مصباح ليد صغير


Paper clip
مشبك ورق


Aluminum foil
ورق الفويل


Electrical tape
شريط كهربائي لاصق


Coin
عملة معدنية


Piece of cloth
قطعة قماش


Rubber (eraser)
ممحاة


Small piece of wood
قطعة صغيرة من الخشب


Two wires with non-insulated ends
سلكين بنهايات غير معزولة

Steps:

1

Use the wires, the small LED lamp and the battery to create an electric circuit.

استخدم الأسلاك ومصباح LED الصغير والبطارية لإنشاء دائرة كهربائية.

2

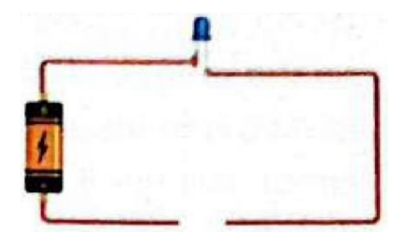
Insert the coin in the circuit as shown to test if it conducts electricity or not.

أدخل العملة في الدائرة كما هو موضح لاختبار ما إذا كانت موصلة للكهرباء أم لا.

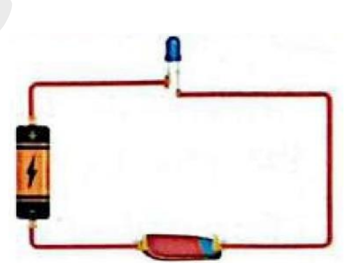
3

Insert the rubber (eraser) in the circuit as shown to test if it conducts electricity or not.

أدخل المطاط (الممحاة) في الدائرة كما هو موضح لاختبار ما إذا كانت موصلة للكهرباء أم لا.







4 Repeat the previous steps to test all materials you have.

كرر الخطوات السابقة لاختبار جميع المواد المتوفرة لديك.

Observations

- The lamp lights when the coin, the aluminum foil or the paper clip are inserted into the circuit.
- The lamp doesn't light when the rubber (eraser), the small piece of wood or the piece of cloth are inserted into the circuit.

- يضيء المصباح عند إدخال العملة المعدنية أو رقائق الألومنيوم أو مشبك الورق في الدائرة.
- لا يضيء المصباح عند إدخال المطاط (الممحاة) أو قطعة الخشب الصغيرة أو قطعة القماش في الدائرة.

Conclusions:

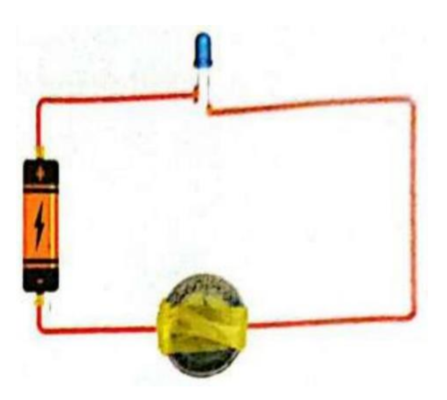
- Materials made of metal (such as the coin, the aluminum foil and the paper clip) are **electric conductors** which conduct enough electricity for the lamp to light.

- Other materials (such as the rubber, the small piece of wood and the piece of cloth) are **electric insulators** which don't conduct electricity for the lamp to light.

الاستنتاجات:

- المواد المصنوعة من المعدن (مثل العملة المعدنية ورقائق الألومنيوم ومشبك الورق) هي **موصلات كهربائية** توصل ما يكفي من الكهرباء لإضاءة المصباح.
- المواد الأخرى (مثل المطاط وقطعة الخشب الصغيرة وقطعة القماش) عبارة عن **عوازل كهربائية** لا توصل الكهرباء حتى يضيء المصباح.

- If you wrap one of the previous electric conductors (such as the coin) with the electrical tape which is made of plastic and insert it again in the circuit, ***the lamp in the circuit will not light because the electric current cannot flow through the plastic***.



- Electric wires are wrapped in plastic which is an insulator to prevent electricity from moving from the metal wire into our hands.

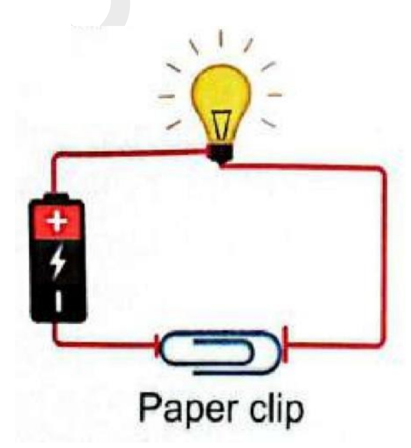
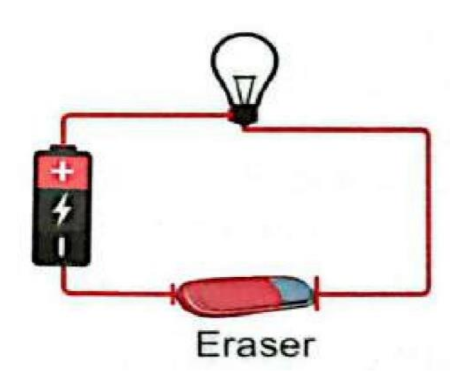
- إذا قمت بلف أحد الموصلات الكهربائية السابقة (مثل العملة المعدنية) بالشريط الكهربائي المصنوع من البلاستيك وأدخلته مرة أخرى في الدائرة فإن المصباح الموجود في الدائرة لن يضيء لأن التيار الكهربائي لا يمكن أن يمر عبر البلاستيك.
- الأسلاك الكهربائية مغلفة بالبلاستيك وهو عازل يمنع انتقال الكهرباء من السلك المعدني إلى أيدينا.



Construct an electric circuit

Difference between electric conductors and insulators.

الفرق بين الموصلات الكهربائية والعوازل.

Electric conductors	Electric insulators
They are materials that allow electrons to flow through them easily. If a conductor (a paper clip) is placed in a circuit with a battery and a light bulb, electricity will flow and the light bulb will light. **الموصلات الكهربائية** ▪ هي مواد تسمح للإلكترونات بالتدفق عبرها بسهولة. ▪ إذا تم وضع موصل (مشبك ورق) في دائرة بها بطارية ومصباح كهربائي، فسوف تتدفق الكهرباء ويضيء المصباح الكهربائي.  	They are materials that do not allow electrons to flow through them easily. If an insulator (an eraser) is placed in a circuit with a battery and a light bulb, electricity will not flow and the light bulb will not light. **العوازل الكهربائية** ▪ هي مواد لا تسمح للإلكترونات بالتدفق عبرها بسهولة. ▪ إذا تم وضع عازل (ممحاة) في دائرة بها بطارية ومصباح كهربائي، فلن تتدفق الكهرباء ولن ي ضيء المصباح الكهربائي. 

Importance of insulators

- Insulators stop the flow of electricity, so they keep you safe from getting shocked by the electric current.
- Plastic is an insulator that coats wires and plugs to keep you safe when you are handling them.

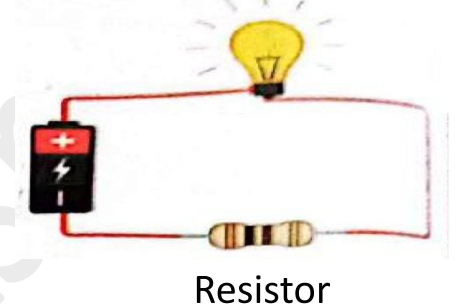
Resistors

- Resistors are used to slow the flow of electrons through an electric circuit to avoid the damage of the components of an electric circuit.

Resistors:
They are components of an electric circuit that limit the flow of electric current.

Resistors can be found in:

- Toasters.
- Electric stoves.
- Microwaves.


Resistor

أهمية العوازل:

- تعمل العوازل على إيقاف تدفق الكهرباء، وبالتالي تحميك من التعرض للصعق بالتيار الكهربائي.
- البلاستيك عبارة عن مادة عازلة تغطي الأسلاك والمقابس للحفاظ على سلامتك عند التعامل معها.

المقاومات

المقاومات :

هي مكونات الدائرة الكهربائية التي تحد من تدفق التيار الكهربائي.

- تستخدم المقاومات لإبطاء تدفق الإلكترونات عبر الدائرة الكهربائية لتجنب تلف مكونات الدائرة الكهربائية.

يمكن العثور على المقاومات في:

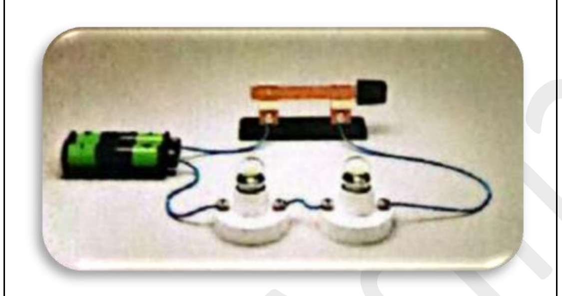
- المحامص - المواقد الكهربائية - الميكروويف

Electric Circuits: Series versus Parallel Circuits

- The electric circuits can be connected in two different ways.
- These circuits are called:
  - Series circuits.
  - Parallel circuits.

الدوائر الكهربائية: الدوائر المتسلسلة مقابل الدوائر المتوازية

- يمكن توصيل الدوائر الكهربائية بطريقتين مختلفتين.
- وتسمى هذه الدوائر:
  - الدوائر المتوالية (دوائر التوصيل على التوالي).
  - الدوائر المتوازية (دوائر التوصيل على التوازي).

Series circuit	Parallel circuit
	
In a series circuit, all the components must be connected in a single loop (one path). The electric current can only flow along one path from the energy source through the circuit and back to the energy source. In a series circuit, we can operate two light bulbs on the same	In a parallel circuit, the light bulbs are connected in two or more different branches of the circuit. The electric current can flow along different parallel branches (more than one path) from the energy source through the circuit and back to the energy source.

circuit, but if one light bulb blows out or is disconnected, the other one will not work.	In a parallel circuit, we can turn off or remove one light bulb while the other light bulb will remain lit.
الدوائر المتوالية: • في الدائرة المتوالية يجب توصيل جميع المكونات في حلقة واحدة (مسار واحد). • لا يمكن للتيار الكهربائي أن يتدفق إلا في مسار واحد من مصدر الطاقة عبر الدائرة ويعود إلى مصدر الطاقة. • في الدائرة المتوالية، يمكننا تشغيل مصباحين كهربائيين على نفس الدائرة، ولكن إذا انطفأت إحدى اللمبتين أو انفصلت، فلن تعمل الأخرى.	**الدوائر المتوازية:** • في الدائرة المتوازية، يتم توصيل المصابيح الكهربائية في فرعين أو أكثر من فروع الدائرة المختلفة. • يمكن للتيار الكهربائي أن يتدفق عبر فروع متوازية مختلفة (أكثر من مسار) من مصدر الطاقة عبر الدائرة ويعود إلى مصدر الطاقة. • في دائرة متوازية، يمكننا إطفاء أو إزالة مصباح واحد بينما يظل المصباح الآخر مضاءً.

Advantage to use parallel circuits:

- Parallel circuits are found in houses, so we can operate the blender, the refrigerator, and the television all at the same time but, if we turn off one of the previous devices, the others will continue to work because they operate on a parallel circuit.

ميزة استخدام الدوائر المتوازية

- الدوائر المتوازية موجودة في المنازل، لذا يمكننا تشغيل الخلاط والثلاجة والتلفزيون في نفس الوقت، ولكن إذا قمنا بإيقاف تشغيل أحد الأجهزة السابقة، فإن الأجهزة الأخرى ستستمر في العمل لأنها تعمل على دائرة متوازية .

Towns and cities are part of an electric circuit, where:

- The energy source is the power plant which has generators that push out electricity.
- Then electricity travels along conductors called power lines into all kinds of electrical devices in houses, businesses, and factories.

المدن والبلدات هي جزء من دائرة كهربائية، حيث:

- ❖ مصدر الطاقة هو محطة توليد الكهرباء التي تحتوي على مولدات تعمل على إخراج الكهرباء.
- ❖ ثم تنتقل الكهرباء عبر موصلات تسمى خطوط الكهرباء إلى جميع أنواع الأجهزة الكهربائية في المنازل والشركات والمصانع.

Magnetism and Electricity

- **In this activity, we will know how a magnet can generate electricity.**

A scientist made an experiment, where:

- He tightly coiled a wire around a hollow cylinder and he connected this coil to a galvanometer.

Galvanometer

It is a device used to detect the flow of small electric currents.

- Then he placed a magnetic bar in different distances from the coil, and he noticed that:


Galvanometer

المغناطيسية والكهرباء:

- **في هذا النشاط، سوف نعرف كيف يمكن للمغناطيس توليد الكهرباء.**

قام أحد العلماء بتجربة حيث:

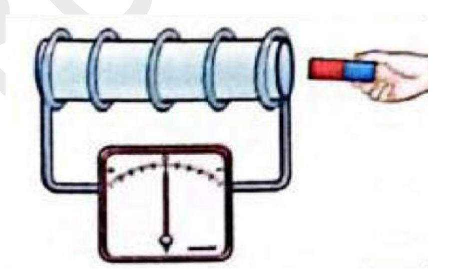
- قام بلف سلك بإحكام حول أسطوانة مجوفة وقام بتوصيل هذا الملف بالجلفانومتر.

الجلفانومتر:

هو جهاز يستخدم لكشف تدفق التيارات الكهربائية الصغيرة.

- ثم وضع شريطاً مغناطيسياً على مسافات مختلفة من الملف فلاحظ أن:

When the magnet was placed at rest away from the coil

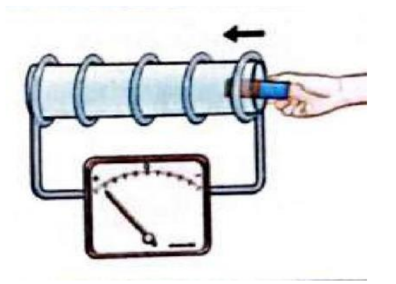


- The needle of the galvanometer did not move, which indicates that there was no electric current flow.

عند وضع المغناطيس في حالة سكون بعيدًا عن الملف:

لم تتحرك إبرة الجلفانومتر، مما يدل على عدم وجود تيار كهربائي.

When the magnet was moved toward and into the coil (cylinder)



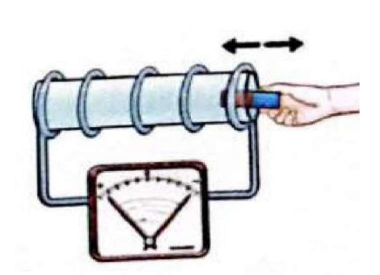
- The needle of the galvanometer moved to one side, which indicates that there was an electric current flow.

عندما تم تحريك المغناطيس باتجاه الملف (الأسطوانة) وإلى داخله:

تحركت إبرة الجلفانومتر إلى أحد الجانبين، مما يدل على وجود تدفق للتيار الكهربائي.

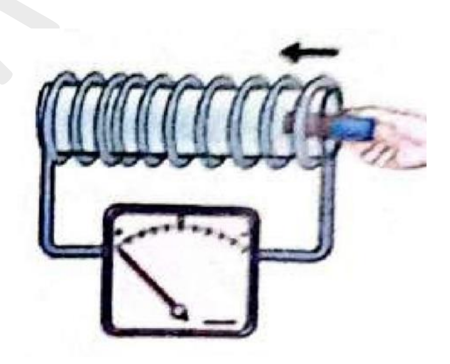
When the magnet was moved **rapidly** back and forth inside the coil

- The needle of the galvanometer also moved rapidly so, he concluded that when the movement of the magnet increases, the generated electric current increases.



عند تحريك المغناطيس بسرعة ذهابًا وإيابًا داخل الملف:
كما تحركت إبرة الجلفانومتر بسرعة كبيرة، فاستنتج أنه عندما تزداد حركة المغناطيس، يزداد التيار الكهربائي المتولد.

- In the previous experiment, **if the number of loops in the coil increases**, ***the movement of the needle of the galvanometer will increase*** which indicates that the amount of generated electric current (voltage) will increase.



في التجربة السابقة، إذا زاد عدد الحلقات في الملف، فإن حركة إبرة الجلفانومتر ستزداد مما يدل على زيادة كمية التيار الكهربائي المتولد (الجهد).

From the previous experiment, we know the relation between magnetism and electricity, which is used in:
من التجربة السابقة عرفنا العلاقة بين المغناطيسية والكهرباء والتي تستخدم في:

Electric motor محرك كهربائى	Electric generator مولد كهربائى	Electric transformer محوّل كهربائى
		



How can an electrical system improve the function of a body system?

Pacemaker

- The heart is a muscle that beats consistently for the duration of our lives.
- The heart has a natural pacemaker which creates electrical currents that it sends out through the heart, causing the heart to contract.
- When the natural pacemaker starts to fail, sometimes we need an artificial pacemaker to keep the heart beating correctly.

كيف يمكن للنظام الكهربائي تحسين وظيفة نظام الجسم

جهاز تنظيم ضربات القلب:

- القلب عبارة عن عضلة تنبض باستمرار طوال حياتنا.
- يحتوي القلب على جهاز تنظيم ضربات القلب الطبيعي الذي يولد تيارات كهربائية يرسلها عبر القلب، مما يؤدي إلى انقباض القلب.
- عندما يبدأ جهاز تنظيم ضربات القلب الطبيعي بالفشل، نحتاج أحيانًا إلى جهاز تنظيم ضربات القلب الاصطناعي للحفاظ على نبض القلب بشكل صحيح.

Artificial pacemaker

- It is a device that operates with a battery.
- It is inserted into the chest and stimulates the heart muscle to beat at regular intervals for patients who have a slow or irregular heartbeats.

- Artificial pacemakers have been in use for over 60 years.

جهاز تنظيم ضربات القلب الاصطناعي:

- هو جهاز يعمل بالبطارية.
- يتم إدخاله في الصدر ويحفز عضلة القلب على النبض على فترات منتظمة للمرضى الذين يعانون من بطء أو عدم انتظام ضربات القلب.
- تم استخدام أجهزة تنظيم ضربات القلب الاصطناعية لأكثر من 60 عامًا.

How to build a pacemaker

To build a pacemaker, you need:

- A battery.
- An insulated electric wire
- A motherboard.

كيفية بناء جهاز تنظيم ضربات القلب:

لبناء جهاز تنظيم ضربات القلب، تحتاج:

- بطارية.
- سلك كهربائي معزول.
- لوحة التحكم الرئيسية.

The future of pacemakers

- The artificial pacemaker has a ***built-in antenna*** to send information to physicians (doctors), so they know how the heart is behaving.
- Pacemakers are getting more advanced by the year and becoming smaller too.
- Today, doctors can place a tiny, effective pacemaker well within the heart with a simple surgery.

مستقبل أجهزة تنظيم ضربات القلب:

- يحتوي جهاز تنظيم ضربات القلب الاصطناعي على **هوائي مدمج** لإرسال المعلومات إلى الأطباء (الأطباء)، حتى يتمكنوا من معرفة كيف يتصرف القلب.
- تتقدم أجهزة تنظيم ضربات القلب بمرور العام وتصبح أصغر حجمًا أيضًا.
- اليوم، يستطيع الأطباء وضع جهاز تنظيم ضربات القلب الصغير والفعال داخل القلب بعملية جراحية بسيطة.

Unit 1 – Concept 3
{ Energy as a system }

outlets	مخارج	fixtures	تركيبات
conductors	المواد الموصّلة	insulators	المواد العازلة
poles	أعمدة	switch	مفتاح
gravity	الجاذبية	magnetism	المغناطيسية
pacemaker	منظم ضربات القلب	electric circuit	دائرة كهربائية
series	توالي	parallel	توازي
light bulb	مصباح كهربائي	trouble	مشكلة
burn out	يحترق	strand of lights	مجموعة من المصابيح
force	قوة	contact	تلامس
mass	كتلة	distance	مسافة
gravitational force	قوة الجاذبية	center	مركز
certain	معين	direct	مباشر
repel	يتنافر	attract	يجذب
magnetic field	المجال المغناطيسي	effects	تأثيرات
iron filings	برادة الحديد	pattern	نمط
outline	مخطط	locate	يقع
item	مادة	steel	الحديد الصلب
aluminium foil	ورق الفويل	iron	حديد

copper	نحاس	approach	يقرّب
metals	معادن	closer	أقرب
far	بعيد	nickel	معدن النيكل
cobalt	معدن الكوبلت	create	يستحدث
lost	يفنى	generator	مولّد
turbine	التوربين	coiled wire	سلك ملفوف
mechanical energy	طاقة حركية	dams	سدود
coal	الفحم	steam	بخار
charges	شحنات	spin	يدور
electric current	تيار كهربائي	tiny	صغير
particles	جزيئات	metal core	قالب معدني
charged	مشحونة	strengthen	يقوّي
wrap	يلف	electrons	الإلكترونات
steady	ثابت	stream	تيار
closed path	مسار مغلق	power lines	خطوط الطاقة الكهربائية
transmit	ينقل	loop	مسار / حلقة
breaks	فواصل	wall socket	مقبس الحائط
common	شائع	tool	أداة
adjust	يضبط	manual	يدوي
automatic	آلي	easily	بسهولة
internal	داخلي	thermostat	الثرموستات
electric shock	صدمة كهربائية	death	الوفاة

non insulated	غير معزول	coating	غلاف
electrical tape	شريط لاصق كهربي	coin	عملة معدنية
eraser	ممحاة	cloth	قماش
insert	يدخل	repeat	يكرر
spoon	ملعقة	metallic	معدني
prevent	يمنع	place	يضع
handle	يلمس	resistors	المقاومات
plugs	المقابس	limit	يحد
branch	فرع	energy source	مصدر الطاقة
blow out	ينطفئ	disconnect	يفصل
remove	يزيل	remain	يظل
blender	الخلاط	lit	مضاء
towns	بلدان	cities	مدن
power plant	محطة توليد الكهرباء	businesses	الشركات
tightly	إحكام	hollow	مجوّف
cylinder	أسطوانة	needle	إبرة / مؤشر
magnetic bar	قضيب مغناطيسي	detect	يكشف
indicate	يشير	back and forth	ذهابا وإيابا
rapidly	بسرعة	galvanometer	الجلفانومتر
rest	سكون	improve	يحسّن
chest	الصدر	natural	طبيعي
artificial	صناعي	motherboard	لوحة التحكم الرئيسية

duration	مدّة	stimulate	يحفّز
consistently	باستمرار	antenna	هوائي

Unit 1 – concept 3 - questions

Lesson 1

Choose the correct answer :

1. Gravity and magnetism are similar in that ....
   a. they are repulsion forces only.
   b. they are attraction forces only.
   c. they are forces that attract all objects.
   d. we cannot see them.

2. When we throw a ball upward it returns back to the Earth due to ....
   a. gravity only c. magnetism only
   b. electricity and mass d. magnetism and electricity

3. The .... of objects and the .... between them affect the gravity force.
   a. mass – color c. mass - distance
   b. distance – mass d. volume - distance

4. The force of Earth's gravity on plane (B) is .... that on plane (A).
   a. greater than c. equal to
   b. smaller than d. double

5. Magnets can be made of ....
   a. copper c. iron
   b. glass d. plastic

6. The area around the magnet in which its force appears is known as ....
   a. magnetic field c. electric current

b. magnetism d. gravity

Put (√) or (x):

1- The force of gravity increases between objects when the distance between them increases. ( )
2- Electric circuit is the path for electricity that consists of many components that work together as one system. ( )
3- Electricity and magnetism can work together. ( )
4- Earth attracts all objects on its surface due to its great mass. ( )
5- During the falling down of an object towards Earth's surface, the gravity force increases. ( )
6- Magnetism is an attraction or a repulsion force, while gravity is a repulsion force only. ( )
7- The force of gravity appears when any object is thrown upward into the air as it will return back to its surface. ( )
8- The magnet has a force called magnetism. ( )
9- Small pieces of paper can be used to see the magnetic field of a magnet. ( )
10- All materials can be attracted to the magnet. ( )

Write the scientific term of each of the following:

- The area around the magnet in which its magnetic force appears. (…………………………………….)
- The force of Earth which attracts all objects on its surface to its center. (………………………………….)

- The force that allows the magnet to attract some materials without making direct contact. (………………………………)

Complete the following sentences:

1) The gravity of Earth is affected by two factors which are ………………………… and …………………….
2) By increasing the distance between objects, the …………………………… force between them …………………………
3) To see the magnetic field of a magnet, we should use …………………… filings.
4) Magnetism is an attraction or ………….. force, while gravity is ……………………… force only.
5) All objects are pulled toward Earth's ……………………….. due to ……………………… force of Earth.
6) Gravity attracts any object that has …………………….

Correct the underlined words:

A) Magnetism is a pulling or pushing force, while gravity is a **pushing** force only. (…………………………)

B) The magnet is surrounded by an area called **magnetism** in which the magnetic force of a magnet appears.

(………………………………)

C) **Gravity** is the force by which a magnet attracts some materials. (………………………)

D) **Electricity** is the force that affects all objects that has mass and attracts them towards Earth's center.

(…………………………….)

E) The force of gravity is affected by two factors which are distance and **color**. (…………………….)

Give reasons for:

- The electric circuit is considered as a system.

……………………………………………………………………………………………

……………………………………………………………………………………………

- When a ball is thrown into the air, it will stop moving upward and then falls down.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens to…:

- The force of gravity if the mass of an object increases.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The force of gravity if the distance between the object and Earth's center increases.

……………………………………………………………………………………………

……………………………………………………………………………………………

Complete the following sentences using the words below:

(**iron filings - magnet – magnetic field – iron**)

1. This tool is called ……………………….

   and it is made of ……………………………

2. This tool is surrounded by an area called

   ……………………………….

3. We can observe the force of this tool

   by using ……………………. which make pattern around it.

Lesson 2

Choose the correct answer:

1. ……………………. is a magnetic material that is attracted to the magnet.
   a. Copper b. Iron c. Gold d. Wood

2. Some materials cannot be attracted to the magnet because they are ………………..
   a. magnetic materials
   b. made of nickel, iron and cobalt
   c. non-magnetic materials
   d. located at the magnetic field of the magnet.

3. When we put a piece of aluminum foil close to a magnet, it will ……………………
   a. be attracted to the magnet

b. be a magnet
c. not attract to the magnet
d. repel with the magnet

4. All the following materials are called magnetic materials, <u>except</u> …………………
   a. iron   b. plastic   c. nickel   d. steel

5. Magnet affects certain objects like ………….. when they locate in its magnetic field.
   a. wood and steel   c. iron and copper
   b. nickel and plastic   d. cobalt and steel

6. The area around the magnet in which magnetism can be observed is known as ………………
   a. magnetic materials   c. non-magnetic materials
   b. magnetic field   d. iron filings

<u>Put (√) or (x):</u>

1- Magnets attract the non-magnetic materials such as iron, nickel and steel. ( )
2- Cobalt is an example of magnetic materials. ( )
3- All magnets can be made of some materials like iron and glass. ( )
4- The magnetic objects are attracted to the magnet at any distance from the magnet. ( )
5- We can use the magnet to separate between some iron nails mixed with small pieces of copper. ( )
6- A piece of aluminum foil and a plastic spoon will be attracted to the magnet. ( )

Write the scientific term of each of the following:

- The materials that are attracted to the magnet.

(……………………………)

- The materials that are not attracted to the magnet.

(…………………………………)

- The area around the magnet at which the magnetic materials are attracted to the magnet.

(……………………………………)

Complete the following sentences:

1) Magnets attract some metals, such as ……………………… , …………………………… and ………………………
2) The magnetic materials will be attracted to the magnet when they are located at ……………… of the magnet.
3) If we put a wooden spoon near to a magnet it will not attract to it because it is made of ………………. material.
4) Materials are classified according to their ability to be attracted to the magnet into ………………………. materials and ………………….. materials.
5) Copper and ………………… will not attract to the magnet as they are …………………….. materials.

Give reasons for:

- Cobalt and nickel are considered as magnetic materials.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Wood and copper are not attracted to the magnet.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens if …:

- A magnet is approached close to some iron nails mixed with small pieces of paper.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The magnetic objects are placed at a distance and do not locate at the magnetic field of this magnet.

……………………………………………………………………………………………

……………………………………………………………………………………………

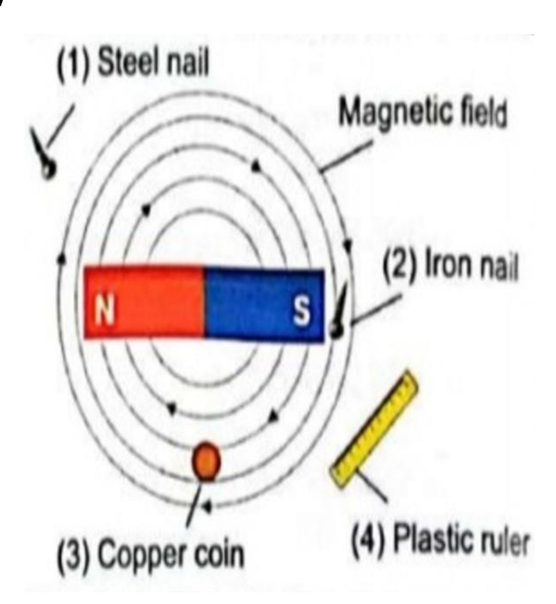
Classify the following materials into magnetic materials and non magnetic materials in the table below:

(**Iron nail - paper clip - plastic spoon – piece of glass - wooden clip – copper wire**)

Magnetic materials	Non-magnetic materials
……………………………………….	…………………………………………
……………………………………..	…………………………………………
………………………………………	………………………………………..
……………………………………….	………………………………………..
………………………………………	………………………………………..

From the opposite figure, choose the correct answer:

1. Material number (s) ………………….. will be attracted to the magnet.
   a. (1) only c. (2) only
   b. (1) and (2) only d. (3) and (4) only



2. Which of these materials are considered as magnetic materials?
   a. (1) and (2) c. (1), (2) and (3)
   b. (3) and (4) d. (1), (3) and (4)

3. Which of these materials are considered as non-magnetic materials?
   a. (1) and (2) c. (1), (2) and (3)
   b. (3) and (4) d. (1), (3) and (4)

Lesson 3

Choose the correct answer :

1. Mechanical energy is converted into energy in the generators.
   a. Light b. sound c. electric d. thermal

2. Generators are used in ……………….
   a. building houses and heating water.
   b. lighting houses and operating electric devices.
   c. producing sound energy.
   d. generating thermal energy.

3. The flow of electric charges along a closed path causes …………………..
   a. electric circuit c. electric current
   b. light energy d. sound energy.

4. ………………… are used to spin the magnet in the generator to produce electricity.
   a. Water and winds c. Electricity and sound
   b. Light and sound d. Sound and heat

5. Magnets are used in generators and …………… to generate ………………….
   a. turbines – sound c. lamps - heat
   b. switches – sound d. turbines - electricity

6. The source of electricity in any electric circuit may be ……………………
   a. a metal wire c. a battery
   b. A switch d. an electric lamp

7. The electric circuit contains ……….. which is responsible for opening and closing the circuit.
a. a battery b. a switch c. a lamp d. a heater

8. When the switch is turned off, it ……………… the circuit, so the electric current …………………
   a. open - will flow through
   b. open - will not flow through
   c. close - will pass through
   d. close – will not pass through

9. All the following materials are considered as electric conductors, <u>except</u> …………….
   a. copper b. water c. rubber d. iron

10. The internal switch on a ………………… can be used in the refrigerator to adjust its temperature.
    a. battery b. thermostat c. light bulb d. wall socket

11. Electric insulators like ……………… and ……………. do not allow electricity flow through them.
    a. copper and plastic c. rubber and plastic
    b. rubber and iron d. copper and iron

12. When electric current flows through your body it ……….
    a. causes an electric shock.
    b. increasing your mass.
    c. decreasing the water level in your body.
    d. does not affect your body.

13. A magnetic field can be formed when electric current flows around ……….
    a. a plastic tube c. a metal core

b. a battery d. a glass core

Choose from column (B) what suits it in column (A):

(A)	(B)
1. Electricity	a. is a closed path through which electrons move.
2. Electric conductors	b. are materials that electric charges flow through.
3. Electric circuit	c. is a source of electric charges in the circuit.
4. Electric insulators	d. is a form of energy.
5. Battery	e. is used to open and close the circuit.
	f. are materials through which electrons can't flow.

Put (√) or (x):

1- Electricity can be produced from magnetism. ( )
2- Water in dams are used to operate wind turbines. ( )
3- To make electric current flow through a circuit, all components must be connected to each other. ( )
4- The electric circuit must contain a source of electricity such as the switch. ( )
5- The thermostat in a refrigerator contains an automatic switch. ( )
6- All materials allow electric current to flow through them. ( )
7- Copper, aluminum and rubber are electric conductors.

( )

8- When the electric circuit is opened, the electric current doesn't flow through it. ( )

9- All metals are electric insulators. ( )

10- Electric wire can be made of copper and covered with plastic or rubber. ( )

<u>Write the scientific term of each of the following:</u>

- The device which changes mechanical energy into electrical energy. (………………………………..)
- A form of energy produced from generators and turbines. (…………………………………..)
- The flow of electrons through an electric wire. (…………………………………..)
- A closed loop through which electric current can flow. (…………………………………..)
- A tool in the circuit which is used to open and close the circuit. (…………………………………..)
- It is used to adjust the temperature inside some devices such as the refrigerator. (……………………………….)
- The materials that the electric charges can flow through. (…………………………………..)
- They are materials that do not allow electric current to flow through. (…………………………………..)

Complete the following sentences:

1) The generator consists of large …………. and ……………………
2) Mechanical energy can be changed into …………………….. energy in the generator.
3) The electric current can transmit in a path called ……………………………….
4) The source of electricity in the electric circuit could be …………………… or ……………………. that transfers current from power lines connected to the building.
5) From the components of the electric circuit ……………………, an electric power source, …………… and an electric device.
6) The tool that opens and close the circuit is called ……………………..
7) When the switch is ………………… , the circuit will be …………………… so the electric current flows.
8) There are materials known as …………………… that allow electrons to flow through such as ……………………. and ……………………….
9) The electric current causes ……………………. in the human body as it contains ……………… that is good conductor of electricity.
10) Wood, ………………… and ………………….. are examples of electric insulators.

Give reasons for:

- Electric generators have great importance in our life.

……………………………………………………………………………………………

……………………………………………………………………………………………

- The electric circuit must contain a battery.

……………………………………………………………………………………………

……………………………………………………………………………………………

- All metals are considered as electric conductors.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Most electric wires are covered with rubber or plastic.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens if…:

❖ Large magnets spin at a high speed, around coiled wires.

……………………………………………………………………………………………

……………………………………………………………………………………………

❖ The electric circuit doesn't contain switch.

……………………………………………………………………………………………

……………………………………………………………………………………………

❖ The switch is closed in the electric circuit.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Look at the opposite figure then answer:

a. This device is called …………………..

b. It consists of ………………… and …………………

c. The idea of its work is changing …………………… energy into …………………………… energy.

d. This device is used ………………….. and ……………………

Look at the opposite figure, then answer the questions:

A) Label the figure:

1. ……………………………

2. …………………………….

3. …………………………….

4. ……………………………..

B) What is the function of device number?

1- ………………………..

2- ………………………..

C) What happens if device number (1) is closed?

………………………………………………………………………………………………

Lesson 4

Choose the correct answer:

1. ………………….. is a material that cannot allow electric current to flow through.
   a. Iron b. Copper c. Plastic d. Cobalt

2. The electric wires can be made of ……………. or ……………...
   a. wood – plastic c. aluminum - copper
   b. rubber- wood d. plastic - rubber

3. The electric wires are covered with ………………… as it is …………………
   a. copper- good conductor of electricity
   b. plastic - bad conductor of electricity
   c. Iron - strong material
   d. Plastic - electric conductor

4. All the following materials are electric insulators, except ……………….
   a. rubber b. plastic c. wood d. steel

5. Which of the following is a poor conductor of electricity and is used to coat wires?...........
   a. A conductor c. A switch
   b. Non insulator d. A battery

6. Metallic materials are considered electric .... , while glass and rubber are considered electric ....
   a. insulators – conductors
   b. conductors – insulators
   c. circuits - conductors
   d. insulators - energy

Put (√) or (x):

1- Wood and plastic are electric insulators. ( )
2- Electric current can flow through all materials. ( )
3- Electric wires are covered with plastic to protect us from electric shock. ( )
4- Electric insulators only allow electric current to pass through them. ( )
5- Copper, rubber and iron are electric conductors. ( )
6- Materials made of metals can conduct electricity. ( )
7- If your hand touches an insulated wire you will be shocked by electricity. ( )
8- Glass is a good conductor of electricity, while water is a bad conductor of electricity. ( )

Complete the following sentences:

1) All metals like .... and .... are called electric ……………………….
2) Some materials called ………………… because they don't allow electric current to flow through them like ……………………. and …………………..
3) Electric wires are made of copper which is an electric ……………………… but they are wrapped in ……………… which is an electric insulator.

4) Electric wires are coated with ………………… or ……………. to protect us from ………………

5) Handles of screwdrivers are made of plastic as it is an electric ……………………………

Give reasons for:

- Electric wires are made of copper.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Electric wires are wrapped in plastic.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens if…:

- Rubber is used in making electric wires instead of copper.

……………………………………………………………………………………………

……………………………………………………………………………………………

- A person touches non insulated electric wire through which an electric current pass.

……………………………………………………………………………………………

……………………………………………………………………………………………

Look at the opposite figure, then answer:

Classify the following materials into materials that will close the circuit and others will not close it? Giving reason?

(**Iron nail - plastic spoon – Rubber – Metallic spoon – Piece of wood – Metallic key**)

- The materials which will close the circuit:

…………………………………………………………………………

The reason:

…………………………………………………………………………

…………………………………………………………………………

- The materials which will not close the circuit:

……………………………………………………………………………………………

The reason:

……………………………………………………………………………………………

Lesson 5

Choose the correct answer:

1. Electricity can flow through …………………..
   a. electric conductors c. wooden bar
   b. electric insulators d. an eraser

2. ………………. are used to stop the flow of electricity.
   a. Resistors c. Electric insulators
   b. Electric conductors d. Galvanometers

3. ……………. can be found in toasters and ………………….
    a. Microwaves - electric stoves
    b. Resistors - electric stoves
    c. Electric stove - resistors
    d. Microwaves – electric resistors

4. In the ……….. circuit, all components are connected in one loop.
    a. open parallel
    b. closed parallel
    c. open series
    d. closed series

5. In a …………, the electric current can flow through different branches.
    a. series circuit
    b. parallel circuit
    c. resistor
    d. microwave

6. …………….. is used to slow the flow of an electric current in the electric circuit.
    a. A battery
    b. A switch
    c. A resistor
    d. A lamp

7. Scientists use a ………………. to detect the flow of small electric currents.
    a. generator
    b. galvanometer
    c. battery
    d. switch

8. Resistors are found in all of the following devices, <u>except</u> ………….
    a. toasters
    b. microwaves
    c. electric stoves
    d. batteries

9. All of the following are from the properties of parallel electric circuits, <u>except</u> ……………….

a. all components are connected together
b. electric current pass in one loop only
c. we can turn off or remove one light bulb without affecting the other light bulbs.
d. electric current flow through different branches.

10. The electric wires are made of …………… that conduct electricity.

a. plastic and glass
b. rubber and aluminum
c. copper and aluminum
d. wood and plastic

<u>Put (√) or (x):</u>

1- In the series circuits, the electric current can flow in different branches. (   )
2- The materials that are used to connect the components of the electric circuit are called electric insulators. (   )
3- Resistors are used to slow the flow of electrons through an electric circuit. (   )
4- The electric insulators keep us safe from getting shocked by the electric current. (   )
5- Towns and cities are parts of an electric circuit. (   )
6- The electric devices in houses are connected in series circuits. (   )
7- The device that is used to detect the small electric current intensity is called galvanometer. (   )
8- When a magnet is placed at rest away from copper coil, an electric current will be produced. (   )
9- The needle of a galvanometer moves on moving a magnet in and out of a copper coil. (   )

10- By increasing the number of loops in any coil and moving a magnet inside it rapidly, the amount of generated electric current will decrease. ( )

11- There is no relation between magnetism and electricity. ( )

Write the scientific term of each of the following:

- One of the components of an electric circuit that is used to limit the flow of electricity through the circuit. (………………………………)
- The type of electric circuits in which all components must be connected in one loop. (………………………………)
- The type of electric circuits that are found in houses and help in operating man devices at the same time. (…………………………………)
- A device can be used to detect the flow of small electric currents. (…………………………………)
- Materials that allow electrons to flow through them easily. (……………………………)
- Materials that don't allow electrons to flow through them easily. (………………………………)

Complete the following sentences:

1) Rubber is an electric ………………, while copper is an electric ………………………

2) Electric wires are coated by ……………………. as it is an electric insulator.
3) Many devices as ……………… , microwaves and electric stoves contain ………………. which are used to slow the electric current.
4) In the ……………. circuit there is only one path that the electric current can flow through.
5) A moving magnet inside a coiled wire can generate ………………….
6) By increasing the number of loops in the coil, and moving a magnet inside it, the amount of generated electric current will …………………….
7) The electric current can flow through different branches in ………………… circuits.
8) Electric circuits in houses are connected in …………….……… way.
9) The relation between magnetism and electricity is used in electric ……………… , electric generators and electric ……………………..

<u>Give reasons for:</u>

- Some electric circuits contain resistors.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

- In the parallel circuit, we can turn off or remove one light bulb while the other light bulb will remain lit.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

- When a magnet is moved rapidly back and forth inside a coil, the needle of the galvanometer connected to the coil moves rapidly.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

What happens if…:

- A large amount of electricity passes through an electric circuit has an electric device, and this circuit does not contain a resistor.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

- Electric circuits in houses are connected in series.

……………………………………………………………………………………………….

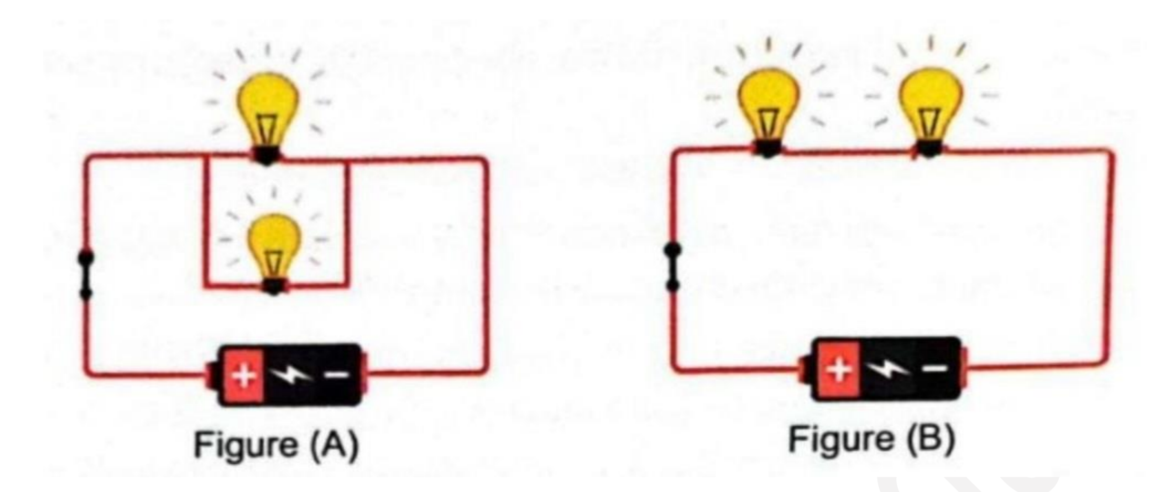
……………………………………………………………………………………………….

- A magnet is moved rapidly inside a coil of wire in a circuit containing galvanometer.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

Look at the following figures then answer:



A) Choose :

1. Which of these figures is a series circuit ?
   (Figure A - Figure B)

2. Which of these figures is a parallel circuit ?
   (Figure A - Figure B)

B) Put (√) or (x):

1. If we remove a lamp from the circuit in figure (A), the other lamp will still lit. (   )
2. If the switch in figure (B) is replaced by a metallic paper clip, all lamps will turn off. (   )

Lesson 6

Choose the correct answer:

1. The ……………… is a muscle that beats inside the human body to push the blood to all body parts.
   a. stomach b. brain c. heart d. hair

2. The normal heart has a ……….. which creates electrical current that cause the heart to ………
    a. natural pacemaker – stop
    b. natural pacemaker – contract
    c. artificial pacemaker - stop
    d. artificial pacemaker – contract

3. The artificial pacemaker is inserted into the ………. of the human body.
    a. brain b. chest c. legs d. hands

4. The artificial pacemaker contains a ……….. to send information to physicians, so they know the condition of the ……………………
    a. battery – lung
    b. motherboard – brain
    c. built-in antenna - heart
    d. battery - heart

Put (√) or (x):

1- Sometimes electricity can be used to help our body parts to move. ( )
2- The heart is important in our body as it helps in food digestion. ( )
3- The natural pacemaker inside our heart creates electrical currents to make it contracts. ( )
4- Scientists use an artificial pacemaker to stimulate the heart muscle to beat regularly. ( )
5- The artificial pacemaker should contain a battery to do its function. ( )

Write the scientific term of each of the following:

- A muscle in the human body that beat regularly to push the blood inside the body. (………………………………)
- A device inserted into the chest to stimulate the heart to beat regularly. (…………………………)

Complete the following sentences:

1) The heart has a natural ……………. which causing the heart to contract.
2) The artificial pacemaker has a built-in ……………. to send information to physicians.
3) To build a pacemaker, ………………… , an insulated electric wire with a coating and ………………… are needed.

Give reasons for:

- Scientists provide the new artificial pacemaker by a built-in antenna.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- The heart has a natural pacemaker.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

What happens if …:

❖ A patient has a slow or irregular heartbeats.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Unit 1 – concept 3 - answers

Lesson 1

Choose the correct answer :

1. Gravity and magnetism are similar in that ....
   a. they are repulsion forces only.
   b. they are attraction forces only.
   c. they are forces that attract all objects.
   d. we cannot see them.

2. When we throw a ball upward it returns back to the Earth due to ....
   a. gravity only c. magnetism only
   b. electricity and mass d. magnetism and electricity

3. The .... of objects and the .... between them affect the gravity force.
   a. mass – color **c. mass - distance**
   b. distance – mass d. volume - distance

4. The force of Earth's gravity on plane (B) is .... that on plane (A).
   a. greater than c. equal to
   b. smaller than d. double

5. Magnets can be made of ....
   a. copper **c. iron**
   b. glass d. plastic

6. The area around the magnet in which its force appears is known as ....
   a. magnetic field c. electric current

b. magnetism d. gravity

Put (√) or (x):

1- The force of gravity increases between objects when the distance between them increases. (**X**)
2- Electric circuit is the path for electricity that consists of many components that work together as one system. (**√**)
3- Electricity and magnetism can work together. (**√**)
4- Earth attracts all objects on its surface due to its great mass. (**√**)
5- During the falling down of an object towards Earth's surface, the gravity force increases. (**√**)
6- Magnetism is an attraction or a repulsion force, while gravity is a repulsion force only. (**X**)
7- The force of gravity appears when any object is thrown upward into the air as it will return back to its surface. (**√**)
8- The magnet has a force called magnetism. (**√**)
9- Small pieces of paper can be used to see the magnetic field of a magnet. (**X**)
10- All materials can be attracted to the magnet. (**X**)

Write the scientific term of each of the following:

- The area around the magnet in which its magnetic force appears. (**magnetic field**)
- The force of Earth which attracts all objects on its surface to its center. (**gravity**)
- The force that allows the magnet to attract some materials without making direct contact. (**magnetism**)

Complete the following sentences:

1) The gravity of Earth is affected by two factors which are **distance** and **mass**.
2) By increasing the distance between objects, the **gravitational** force between them **decreases**.
3) To see the magnetic field of a magnet, we should use **iron** filings.
4) Magnetism is an attraction or **repulsion** force, while gravity is **attraction** force only.
5) All objects are pulled toward Earth's **surface** due to **gravity** force of Earth.
6) Gravity attracts any object that has **mass**.

Correct the underlined words:

A) Magnetism is a pulling or pushing force, while gravity is a **pushing** force only. (**pulling**)
B) The magnet is surrounded by an area called **magnetism** in which the magnetic force of a magnet appears. (**magnetic field**)
C) **Gravity** is the force by which a magnet attracts some materials. (**magnetism**)
D) **Electricity** is the force that affects all objects that has mass and attracts them towards Earth's center. (**gravity**)
E) The force of gravity is affected by two factors which are distance and **color**. (**mass**)

Give reasons for:

- The electric circuit is considered as a system.
  - **Because the electric circuit is a path for electricity that consists of many components that work together as one system.**

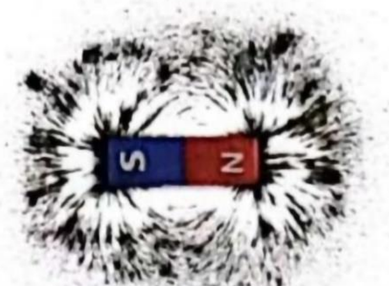
- When a ball is thrown into the air, it will stop moving upward and then falls down.
    - **Due to the gravity force of Earth.**

What happens to…:

- The force of gravity if the mass of an object increases.
    - **The force of gravity will increase.**
- The force of gravity if the distance between the object and Earth's center increases.
    - **The force of gravity between them will decrease.**

Complete the following sentences using the words below:

(**iron filings - magnet – magnetic field – iron**)



1. This tool is called **magnet** and it is made of **iron**.
2. This tool is surrounded by an area called **magnetic field**.
3. We can observe the force of this tool by using **iron filings** which make pattern around it.

Lesson 2

Choose the correct answer:

1. …………………… is a magnetic material that is attracted to the magnet.
    a. Copper **b. Iron** c. Gold d. Wood

2. Some materials cannot be attracted to the magnet because they are ....
   a. magnetic materials
   b. made of nickel, iron and cobalt
   c. non-magnetic materials
   d. located at the magnetic field of the magnet.

3. When we put a piece of aluminum foil close to a magnet, it will ....
   a. be attracted to the magnet
   b. be a magnet
   c. not attract to the magnet
   d. repel with the magnet

4. All the following materials are called magnetic materials, except ....
   a. iron   b. plastic   c. nickel   d. steel

5. Magnet affects certain objects like .... when they locate in its magnetic field.
   a. wood and steel   c. iron and copper
   b. nickel and plastic   d. cobalt and steel

6. The area around the magnet in which magnetism can be observed is known as ....
   a. magnetic materials   c. non-magnetic materials
   b. magnetic field   d. iron filings

Put (√) or (x):

1- Magnets attract the non-magnetic materials such as iron, nickel and steel. (X)

2- Cobalt is an example of magnetic materials. (√)

3- All magnets can be made of some materials like iron and glass. (**X**)

4- The magnetic objects are attracted to the magnet at any distance from the magnet. (**X**)

5- We can use the magnet to separate between some iron nails mixed with small pieces of copper. (**√**)

6- A piece of aluminum foil and a plastic spoon will be attracted to the magnet. (**X**)

Write the scientific term of each of the following:

- The materials that are attracted to the magnet.
  (**magnetic materials**)
- The materials that are not attracted to the magnet.
  (**non-magnetic materials**)
- The area around the magnet at which the magnetic materials are attracted to the magnet.
  (**magnetic field**)

Complete the following sentences:

1) Magnets attract some metals, such as **iron**, **nickel** and **cobalt**.
2) The magnetic materials will be attracted to the magnet when they are located at **the magnetic field** of the magnet.
3) If we put a wooden spoon near to a magnet it will not attract to it because it is made of **non-magnetic** material.
4) Materials are classified according to their ability to be attracted to the magnet into **magnetic** materials and **non-magnetic** materials.
5) Copper and **plastic** will not attract to the magnet as they are **non-magnetic** materials.

Give reasons for:

- Cobalt and nickel are considered as magnetic materials.
  - **Because they are attracted to the magnet.**

- Wood and copper are not attracted to the magnet.
  - **Because they are non-magnetic materials.**

What happens if …:

- A magnet is approached close to some iron nails mixed with small pieces of paper.
  - **The magnet will attract the iron nails but it will not attract the small pieces of paper.**

- The magnetic objects are placed at a distance and do not locate at the magnetic field of this magnet.
  - **They will not be attracted to the magnet.**

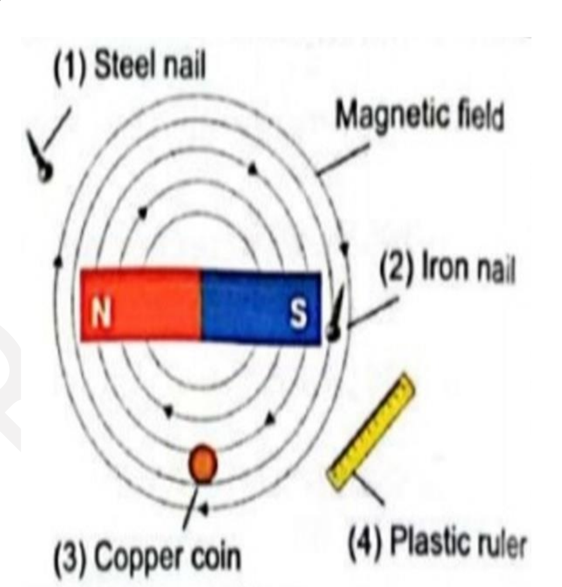
Classify the following materials into magnetic materials and non magnetic materials in the table below:

(**Iron nail - paper clip - plastic spoon – piece of glass - wooden clip – copper wire**)

Magnetic materials	Non-magnetic materials
▪ Iron nail ▪ Paper clip	▪ Plastic spoon ▪ Piece of glass ▪ Wooden clip ▪ Copper wire

From the opposite figure, choose the correct answer:

1. Material number (s) .... will be attracted to the magnet.
   a. (1) only
   b. (1) and (2) only
   c. (2) only
   d. (3) and (4) only



2. Which of these materials are considered as magnetic materials?
   a. (1) and (2)
   b. (3) and (4)
   c. (1), (2) and (3)
   d. (1), (3) and (4)

3. Which of these materials are considered as non-magnetic materials?
   a. (1) and (2)
   b. (3) and (4)
   c. (1), (2) and (3)
   d. (1), (3) and (4)

Lesson 3

Choose the correct answer:

1. Mechanical energy is converted into energy in the generators.
   a. Light b. sound c. electric d. thermal

2. Generators are used in ....
   a. building houses and heating water.
   b. lighting houses and operating electric devices.
   c. producing sound energy.
   d. generating thermal energy.

3. The flow of electric charges along a closed path causes ………………….
   a. electric circuit c. electric current
   b. light energy d. sound energy.

4. ………………… are used to spin the magnet in the generator to produce electricity.
   a. Water and winds c. Electricity and sound
   b. Light and sound d. Sound and heat

5. Magnets are used in generators and …………… to generate …………………
   a. turbines – sound c. lamps - heat
   b. switches – sound d. turbines - electricity

6. The source of electricity in any electric circuit may be ……………………
   a. a metal wire c. a battery
   b. A switch d. an electric lamp

7. The electric circuit contains ……….. which is responsible for opening and closing the circuit.
   a. a battery b. a switch c. a lamp d. a heater

8. When the switch is turned off, it ………………. the circuit, so the electric current …………………
   a. open - will flow through
   b. open - will not flow through
   c. close - will pass through
   d. close – will not pass through

9. All the following materials are considered as electric conductors, <u>except</u> ……………

a. copper b. water c. rubber d. iron

10. The internal switch on a ………………… can be used in the refrigerator to adjust its temperature.
    a. battery b. thermostat c. light bulb d. wall socket

11. Electric insulators like ………………. and ……………. do not allow electricity flow through them.
    a. copper and plastic
    b. rubber and iron
    c. rubber and plastic
    d. copper and iron

12. When electric current flows through your body it ……….
    a. causes an electric shock.
    b. increasing your mass.
    c. decreasing the water level in your body.
    d. does not affect your body.

13. A magnetic field can be formed when electric current flows around ……….
    a. a plastic tube
    b. a battery
    c. a metal core
    d. a glass core

Choose from column (B) what suits it in column (A):

(A)		(B)
1. Electricity	d	a. is a closed path through which electrons move.
2. Electric conductors	b	b. are materials that electric charges flow through.
3. Electric circuit	a	c. is a source of electric charges in the circuit.

4. Electric insulators **f**	d. is a form of energy.
5. Battery **c**	e. is used to open and close the circuit.
	f. are materials through which electrons can't flow.

Put (√) or (x):

1- Electricity can be produced from magnetism. (**√**)
2- Water in dams are used to operate wind turbines. (**X**)
3- To make electric current flow through a circuit, all components must be connected to each other. (**√**)
4- The electric circuit must contain a source of electricity such as the switch. (**X**)
5- The thermostat in a refrigerator contains an automatic switch. (**√**)
6- All materials allow electric current to flow through them. (**X**)
7- Copper, aluminum and rubber are electric conductors. (**X**)
8- When the electric circuit is opened, the electric current doesn't flow through it. (**√**)
9- All metals are electric insulators. (**X**)
10- Electric wire can be made of copper and covered with plastic or rubber. (**√**)

Write the scientific term of each of the following:

- The device which changes mechanical energy into electrical energy. (**generator**)
- A form of energy produced from generators and turbines. (**electricity**)
- The flow of electrons through an electric wire. (**electric current**)
- A closed loop through which electric current can flow.

(**electric circuit**)

- A tool in the circuit which is used to open and close the circuit. (**switch**)
- It is used to adjust the temperature inside some devices such as the refrigerator. (**thermostat**)
- The materials that the electric charges can flow through. (**electric conductors**)
- They are materials that do not allow electric current to flow through. (**electric insulators**)

Complete the following sentences:

1) The generator consists of large **magnets** and **coiled wires**.
2) Mechanical energy can be changed into **electrical** energy in the generator.
3) The electric current can transmit in a path called **electric circuit**.
4) The source of electricity in the electric circuit could be **a battery** or **a wall socket** that transfers current from power lines connected to the building.
5) From the components of the electric circuit **metal wire** an electric power source, **switch** and an electric device.
6) The tool that opens and close the circuit is called **switch**.
7) When the switch is **closed**, the circuit will be **turned on** so the electric current flows.
8) There are materials known as **electric conductors** that allow electrons to flow through such as **copper** and **iron**.
9) The electric current causes **electric shock** in the human body as it contains **water** that is good conductor of electricity.
10) Wood, **glass** and plastic are examples of electric insulators.

Give reasons for:

- Electric generators have great importance in our life.
  - **Because they are used in lighting houses and operating electrical devices.**
- The electric circuit must contain a battery.
  - **Because the battery is the source of electricity in the electric circuit.**
- All metals are considered as electric conductors.
  - **Because they allow electric current to flow through them easily.**
- Most electric wires are covered with rubber or plastic.
  - **Because rubber and plastic are bad conductors of electricity to protect people from electric shock.**

What happens if…:

- Large magnets spin at a high speed, around coiled wires.
  - **The spinning magnets create electrical charges on the coiled wires, so electricity is produced.**
- The electric circuit doesn't contain switch.
  - **We can't open or close the circuit.**
- The switch is closed in the electric circuit.
  - **The electric circuit will be closed, so the electric current flows through the circuit.**

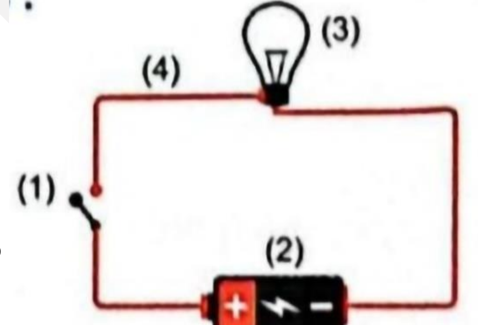
Look at the opposite figure then answer:



a. This device is called **electric generator**.
b. It consists of **large magnets** and **coiled wires**.
c. The idea of its work is changing **mechanical** energy into **electrical** energy.
d. This device is used **lighting houses** and **operating electrical devices**.

Look at the opposite figure, then answer the questions:

A) Label the figure:



1. **Switch**
2. **Battery**
3. **Lamp**
4. **Metal wire**

B) What is the function of device number?

1- It's used to open and close the circuit.
2- It's the source of electricity in the circuit.

C) What happens if device number (1) is closed?

- **The electric circuit will be closed, so the electric current flows through the circuit.**

Lesson 4

Choose the correct answer:

1. ………………….. is a material that cannot allow electric current to flow through.
   a. Iron b. Copper c. Plastic d. Cobalt

2. The electric wires can be made of .... or ....
   a. wood – plastic
   b. rubber- wood
   c. aluminum - copper
   d. plastic - rubber

3. The electric wires are covered with .... as it is ....
   a. copper- good conductor of electricity
   b. plastic - bad conductor of electricity
   c. Iron - strong material
   d. Plastic - electric conductor

4. All the following materials are electric insulators, <u>except</u> ....
   a. rubber
   b. plastic
   c. wood
   d. steel

5. Which of the following is a poor conductor of electricity and is used to coat wires?...........
   a. A conductor
   b. Non insulator
   c. A switch
   d. A battery

6. Metallic materials are considered electric .... , while glass and rubber are considered electric ....
   a. insulators – conductors
   b. conductors – insulators
   c. circuits - conductors
   d. insulators - energy

<u>Put (√) or (x):</u>

1- Wood and plastic are electric insulators. (√)
2- Electric current can flow through all materials. (X)
3- Electric wires are covered with plastic to protect us from electric shock. (√)
4- Electric insulators only allow electric current to pass through them. (X)
5- Copper, rubber and iron are electric conductors. (X)

6- Materials made of metals can conduct electricity. (**√**)

7- If your hand touches an insulated wire you will be shocked by electricity. (**X**)

8- Glass is a good conductor of electricity, while water is a bad conductor of electricity. (**X**)

Complete the following sentences:

1) All metals like **copper** and **aluminum** are called electric **conductors**.
2) Some materials called **electric insulators** because they don't allow electric current to flow through them like **plastic** and **rubber**.
3) Electric wires are made of copper which is an electric **conductor** but they are wrapped in **plastic** which is an electric insulator.
4) Electric wires are coated with **plastic** or **rubber** to protect us from **electric shock**.
5) Handles of screwdrivers are made of plastic as it is an electric **insulator**.

Give reasons for:

- Electric wires are made of copper.
  - **Because copper is an electric conductor that allow electric current to flow through.**

- Electric wires are wrapped in plastic.
  - **Because plastic is an electric insulator to prevent electricity from moving from the metal wire into our hands.**

What happens if…:

- ❖ Rubber is used in making electric wires instead of copper.
  - **The electric current will not flow through the wire.**

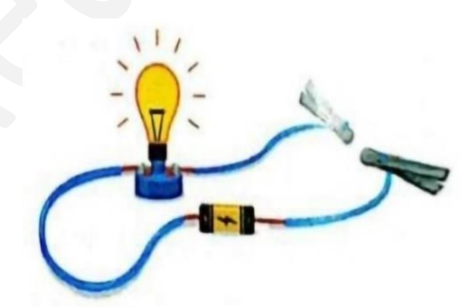
❖ A person touches non insulated electric wire through which an electric current pass.

- **The electric current will flow through his body and will be shocked by electricity.**

Look at the opposite figure, then answer:

Classify the following materials into materials that will close the circuit and others will not close it? Giving reason?

(**Iron nail - plastic spoon – Rubber – Metallic spoon – Piece of wood – Metallic key**)



- The materials which will close the circuit:
  Iron nail – metallic spoon – metallic key

The reason:

Because they are electric conductors.

- The materials which will not close the circuit:
  Plastic spoon – rubber – piece of wood

The reason:

Because they are electric insulators.

Lesson 5

Choose the correct answer:

1. Electricity can flow through …………………..
   - a. electric conductors (circled)
   - b. electric insulators
   - c. wooden bar
   - d. an eraser

2. ……………… are used to stop the flow of electricity.
   - a. Resistors
   - b. Electric conductors
   - c. Electric insulators (circled)
   - d. Galvanometers

3. ……………. can be found in toasters and …………………
   a. Microwaves - electric stoves
   b. Resistors - electric stoves
   c. Electric stove - resistors
   d. Microwaves – electric resistors

4. In the ………. circuit, all components are connected in one loop.
   a. open parallel
   b. closed parallel
   c. open series
   d. closed series

5. In a …………, the electric current can flow through different branches.
   a. series circuit
   b. parallel circuit
   c. resistor
   d. microwave

6. ……………… is used to slow the flow of an electric current in the electric circuit.
   a. A battery
   b. A switch
   c. A resistor
   d. A lamp

7. Scientists use a ………………. to detect the flow of small electric currents.
   a. generator
   b. galvanometer
   c. battery
   d. switch

8. Resistors are found in all of the following devices, except …………..
   a. toasters
   b. microwaves
   c. electric stoves
   d. batteries

9. All of the following are from the properties of parallel electric circuits, except ………………

a. all components are connected together
b. electric current pass in one loop only
c. we can turn off or remove one light bulb without affecting the other light bulbs.
d. electric current flow through different branches.

10. The electric wires are made of .... that conduct electricity.
a. plastic and glass
b. rubber and aluminum
c. copper and aluminum
d. wood and plastic

Put (√) or (x):

1- In the series circuits, the electric current can flow in different branches. (X)
2- The materials that are used to connect the components of the electric circuit are called electric insulators. (X)
3- Resistors are used to slow the flow of electrons through an electric circuit. (√)
4- The electric insulators keep us safe from getting shocked by the electric current. (√)
5- Towns and cities are parts of an electric circuit. (√)
6- The electric devices in houses are connected in series circuits. (X)
7- The device that is used to detect the small electric current intensity is called galvanometer. (√)
8- When a magnet is placed at rest away from copper coil, an electric current will be produced. (X)
9- The needle of a galvanometer moves on moving a magnet in and out of a copper coil. (√)
10- By increasing the number of loops in any coil and moving a magnet inside it rapidly, the amount of generated electric current will decrease. (X)
11- There is no relation between magnetism and electricity. (X)

Write the scientific term of each of the following:

- One of the components of an electric circuit that is used to limit the flow of electricity through the circuit. (**resistor**)
- The type of electric circuits in which all components must be connected in one loop. (**series circuits**)
- The type of electric circuits that are found in houses and help in operating man devices at the same time. (**parallel circuits**)
- A device can be used to detect the flow of small electric currents. (**galvanometer**)
- Materials that allow electrons to flow through them easily. (**electric conductors**)
- Materials that don't allow electrons to flow through them easily. (**electric insulators**)

Complete the following sentences:

1) Rubber is an electric **insulator**, while copper is an electric **conductor**.
2) Electric wires are coated by **plastic** as it is an electric insulator.
3) Many devices as **toasters** , microwaves and electric stoves contain **resistors** which are used to slow the electric current.
4) In the **series** circuit there is only one path that the electric current can flow through.
5) A moving magnet inside a coiled wire can generate **electric current**.
6) By increasing the number of loops in the coil, and moving a magnet inside it, the amount of generated electric current will **increase**.
7) The electric current can flow through different branches in **parallel** circuits.
8) Electric circuits in houses are connected in **parallel** way.

9) The relation between magnetism and electricity is used in electric **motors**, electric generators and electric **transformers**.

Give reasons for:

- Some electric circuits contain resistors.
    - **Because resistors are used to slow the flow of electrons through an electric circuit to avoid the damage of its components.**
- In the parallel circuit, we can turn off or remove one light bulb while the other light bulb will remain lit.
    - **Because in the parallel circuit, the electric current can flow along different branches.**
- When a magnet is moved rapidly back and forth inside a coil, the needle of the galvanometer connected to the coil moves rapidly.
    - **Because when the magnet moves inside the coil of wire, an electric current flow.**

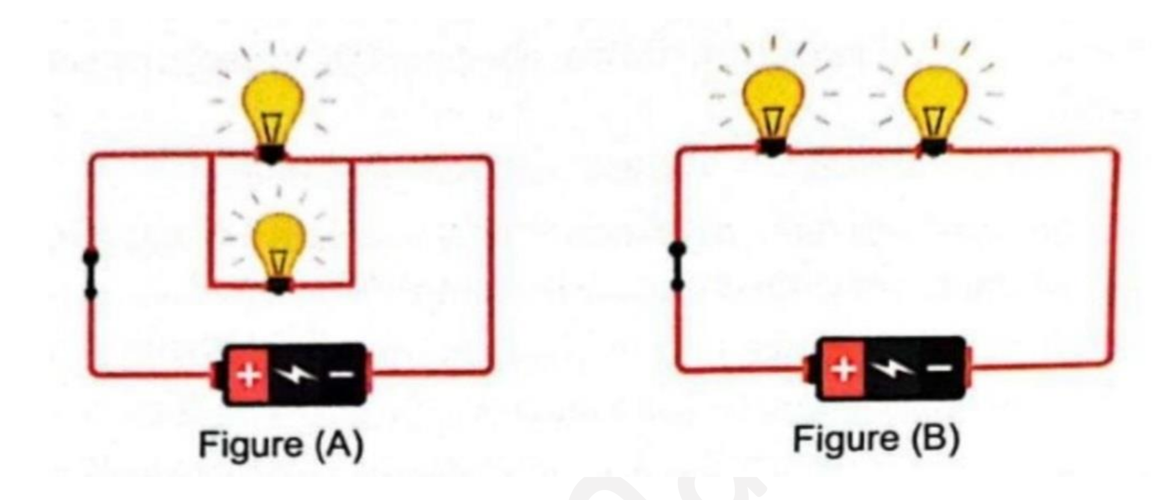
What happens if…:

- A large amount of electricity passes through an electric circuit has an electric device, and this circuit does not contain a resistor.
    - **The components of the electric circuit will be damaged.**
- Electric circuits in houses are connected in series.
    - **If one light bulb blows out or is disconnected, the other one will not work.**

❖ A magnet is moved rapidly inside a coil of wire in a circuit containing galvanometer.

- **The needle of the galvanometer will move rapidly, and the generated electric current will increase.**

Look at the following figures then answer :



A) Choose :

1. Which of these figures is a series circuit ?
(Figure A - **Figure B**)

2. Which of these figures is a parallel circuit ?
(**Figure A** - Figure B)

B) Put (√) or (x):

1. If we remove a lamp from the circuit in figure (A), the other lamp will still lit. (**√**)
2. If the switch in figure (B) is replaced by a metallic paper clip, all lamps will turn off. (**X**)

Lesson 6

Choose the correct answer:

1. The ……………… is a muscle that beats inside the human body to push the blood to all body parts.
   a. stomach   b. brain   c. heart   d. hair

2. The normal heart has a ………. which creates electrical current that cause the heart to ………
   a. natural pacemaker – stop
   b. natural pacemaker – contract
   c. artificial pacemaker - stop
   d. artificial pacemaker – contract

3. The artificial pacemaker is inserted into the ………. of the human body.
   a. brain   b. chest   c. legs   d. hands

4. The artificial pacemaker contains a ………. to send information to physicians, so they know the condition of the ……………………
   a. battery – lung   c. built-in antenna - heart
   b. motherboard – brain   d. battery – heart

Put (√) or (x):

1- Sometimes electricity can be used to help our body parts to move. (√)
2- The heart is important in our body as it helps in food digestion. (X)
3- The natural pacemaker inside our heart creates electrical currents to make it contracts. (√)

4- Scientists use an artificial pacemaker to stimulate the heart muscle to beat regularly. (**√**)

5- The artificial pacemaker should contain a battery to do its function. (**√**)

Write the scientific term of each of the following:

- A muscle in the human body that beat regularly to push the blood inside the body. (**heart**)
- A device inserted into the chest to stimulate the heart to beat regularly. (**artificial pacemaker**)

Complete the following sentences:

1) The heart has a natural **pacemaker** which causing the heart to contract.
2) The artificial pacemaker has a built-in **antenna** to send information to physicians.
3) To build a pacemaker, **a battery** , an insulated electric wire with a coating and **a motherboard** are needed.

Give reasons for:

- Scientists provide the new artificial pacemaker by a built-in antenna.
    - **To send information to physicians, so they know how the heart is behaving.**

- The heart has a natural pacemaker.
    - **To create electric current that sends out through the heart, causing the heart to contract.**

What happens if ...:

- A patient has a slow or irregular heartbeats.
    - **An artificial pacemaker is inserted into the chest and stimulates the heart muscle to beat at regular intervals.**

Unit 2 – concept 1
{ thermal energy and states of matter }

Lesson 1

- The opposite picture shows a hot spring which is formed as follows:



  - Ground water is heated by molten rocks which are found deep in Earth, then this water rises to the surface of Earth and begins to boil.
  - The boiling water in the hot spring changes into steam which is the gas state of water.

- الصورة المقابلة توضح ينبوعاً حاراً يتكون على النحو التالي:
  - يتم تسخين المياه الجوفية بواسطة الصخور المنصهرة الموجودة في أعماق الأرض، ثم يرتفع هذا الماء إلى سطح الأرض ويبدأ في الغليان.
  - يتحول الماء المغلي في الينابيع الساخنة إلى بخار وهي الحالة الغازية للماء.

How are changes in thermal energy, heat transfer and temperature related to particles in matter?

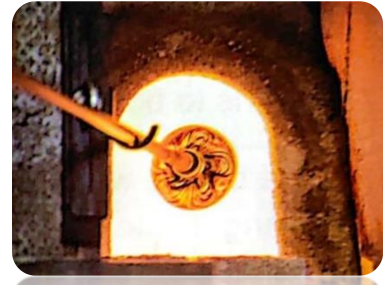
- **Thermal energy depends on the movement of particles of matter, where in the water of the hot spring:**
  - When ***the water is heated***, ***its particles move faster*** and transfer thermal energy between each other in the form of heat.
  - When ***the thermal energy of particles increases*** this leads to ***change in the temperature and the state of water***.

كيف ترتبط التغيرات في الطاقة الحرارية وانتقال الحرارة ودرجة الحرارة بالجزيئات الموجودة في المادة؟

- **تعتمد الطاقة الحرارية على حركة جزيئات المادة، حيث يوجد في مياه الينابيع الحارة:**
  - عندما يسخن الماء، تتحرك جزيئاته بشكل أسرع وتنتقل الطاقة الحرارية فيما بينها على شكل حرارة.
  - عندما تزيد الطاقة الحرارية للجزيئات يؤدي ذلك إلى تغير في درجة حرارة الماء وحالته.

Glassblowing

- Manufacturing of glass depends on changing the glass from one state to another.


Molten glass

- When the glass (solid state) is heated at ***very high temperatures***, it changes into molten glass (liquid state).

- ***Glassblowing*** is a process to form different shapes of glassware by using a hollow tube contains molten glass at one end of its ends, where:



- The molten glass could be blown by a person from the open end of the **hollow tube**, and he could make different shapes of molten glass.
- Then, the molten glass is cooled forming different shapes of glassware.

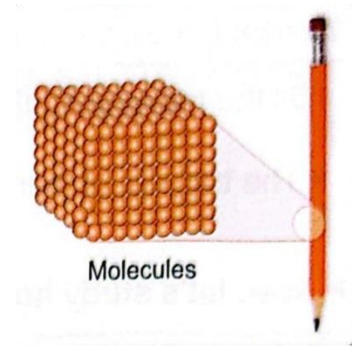
نفخ الزجاج:

- صناعة الزجاج تعتمد على تغيير الزجاج من حالة إلى أخرى.
- عندما يتم تسخين الزجاج (الحالة الصلبة) عند **درجات حرارة عالية جداً**، فإنه يتحول إلى الزجاج المنصهر (الحالة السائلة).
- **نفخ الزجاج** هو عملية تشكيل أشكال مختلفة من الأواني الزجاجية باستخدام أنبوب مجوف يحتوي على زجاج منصهر في أحد طرفيه، حيث:
  - يمكن للإنسان نفخ الزجاج المنصهر من الطرف المفتوح **للأنبوب المجوف**، ويمكنه صنع أشكال مختلفة من الزجاج المنصهر.
  - ثم يتم تبريد الزجاج المنصهر ليشكل أشكالاً مختلفة من الأواني الزجاجية.

What Do you Already know About Thermal Energy in States of Matter?

You have already know that:

- Everything around us is made of matter.
- Matter can change from one state into another.
- All matter is made of particles called atoms and molecules.



ماذا تعرف بالفعل عن الطاقة الحرارية في حالات المادة؟

- **لقد عرفت بالفعل أن:**
  - كل شيء حولنا مصنوع من المادة.
  - يمكن للمادة أن تتغير من حالة إلى أخرى.
  - تتكون كل المادة من جزيئات تسمى الذرات والجزيئات.

Molecule

It is a group of atoms bound together.

الجزيء:

هي عبارة عن مجموعة من الذرات المرتبطة ببعضها البعض.

Atom

It is the smallest building unit of matter.

الذرة:

هي أصغر وحدة بناء للمادة.

The following table shows some properties of different states of matter:

يبين الجدول التالي بعض خواص حالات المادة المختلفة:

Solids	Liquids	Gases
Shape and volume: They are substances that have ***fixed*** shape and volume. **المواد الصلبة:** **الشكل والحجم:** هي مواد لها شكل وحجم ثابتان.	**Shape and volume:** They are substances that have ***fixed*** volume and ***variable*** shape. **السوائل:** **الشكل والحجم:** هي المواد التي لها حجم ثابت وشكل متغير.	**Shape and volume:** They are substances that have ***variable*** shape and volume. **الغازات:** **الشكل والحجم:** هي مواد ذات شكل وحجم متغيرين.

Molecules: ✚ Their molecules are held together tightly in their positions. ✚ Their molecules vibrate around their places. **الجزيئات:** - جزيئاتها متماسكة معًا بإحكام في مواقعها. - تهتز جزيئاتها حول أماكنها.	Molecules: ✚ Their molecules are held together more loosely than molecules of solids. ✚ Their molecules move faster than solids and slide over each other. **الجزيئات:** - يتم تجميع جزيئاتها معًا بشكل فضفاض أكثر من جزيئات المواد الصلبة. - تتحرك جزيئاتها بشكل أسرع من المواد الصلبة وتنزلق فوق بعضها البعض.	Molecules: ✚ Their molecules are not held together as they are much more loosely than molecules of liquids. ✚ Their molecules move independently in all directions. **الجزيئات:** - لا تتماسك جزيئاتها معًا لأنها أكثر رخاوة من جزيئات السوائل. - تتحرك جزيئاتها بشكل مستقل في كل الاتجاهات.

Thermal energy in states of matter:

- All matter contains thermal energy.

Thermal energy

It is the movement of particles of an object.

- The transfer of thermal energy is called ***heat***.

الطاقة الحرارية في حالات المادة:

- كل المادة تحتوي على طاقة حرارية.

الطاقة الحرارية:

هي حركة جزيئات الجسم.

- يسمى نقل الطاقة الحرارية **بالحرارة**.

How much thermal energy in different states of matter:

مقدار الطاقة الحرارية في حالات المادة المختلفة:

Solids	Liquids	Gases
Particles of solid matter move slowly, so they have the ***least*** thermal energy. ***Example***: Ice cubes. **المواد الصلبة** تتحرك جزيئات المادة الصلبة ببطء، لذا فهي تمتلك **أقل** طاقة حرارية. **مثال**: مكعبات الثلج.	Particles of liquid matter move more faster, so they have ***moderate*** thermal energy. ***Example***: Water **السوائل** تتحرك جزيئات المادة السائلة بشكل أسرع، لذلك تتمتع بطاقة حرارية **معتدلة**. **مثال**: الماء.	Particles of gas matter move very fast, so they have the ***most*** thermal energy. ***Example***: Steam. **الغازات** تتحرك جزيئات المادة الغازية بسرعة كبيرة، لذا فهي تتمتع **بأكبر** قدر من الطاقة الحرارية. **مثال**: البخار.

Lesson 2

Thermal energy, heat transfer and temperature

Thermal energy:

- Kinetic energy is the energy that molecules and atoms of a substance has due to their motion.

- Thermal energy of a substance relates to kinetic energy of its molecules and atoms, where:
  - *Thermal energy of a substance is the total sum of kinetic energy of its molecules and atoms*.

Example:

The molecules of solids are not moving as fast as molecules of liquids, so solids have less thermal energy than liquids.

- Thermal energy (heat) transfers from one substance to another if they have different temperatures, where:
  - Heat flows from a ***hotter substance*** to a ***colder substance***.

Example:

If you hold ice cubes in your hand that has more thermal energy than the ice cubes, so the ice cubes will melt because heat flows from your hand (hotter substance) to the ice cubes (colder substance).



temperature

It is a measure of the average kinetic energy of molecules and atoms of a substance.

الطاقة الحرارية:

- الطاقة الحركية هي الطاقة التي تمتلكها جزيئات وذرات المادة بسبب حركتها.
- الطاقة الحرارية للمادة ترتبط بالطاقة الحركية لجزيئاتها وذراتها حيث:

- ***الطاقة الحرارية للمادة هي مجموع الطاقة الحركية لجزيئاتها وذراتها.***

مثال: لا تتحرك جزيئات المواد الصلبة بالسرعة التي تتحرك بها جزيئات السوائل، لذا فإن للأحمق طاقة حرارية أقل من السوائل.

- تنتقل الطاقة الحرارية (الحرارة) من مادة إلى أخرى إذا كانت درجات حرارتها مختلفة، حيث:
  - تتدفق الحرارة من مادة **أكثر سخونة** إلى مادة **أكثر برودة**.

مثال:

إذا كنت تحمل في يدك مكعبات ثلج تحتوي على طاقة حرارية أكثر من مكعبات الثلج، فإن مكعبات الثلج سوف تذوب لأن الحرارة تتدفق من يدك (المادة الأكثر سخونة) إلى مكعبات الثلج (المادة الأكثر برودة).

درجة الحرارة:

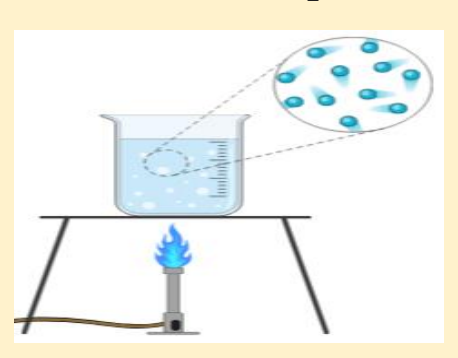
هو مقياس لمتوسط الطاقة الحركية لجزيئات وذرات المادة.

When a substance is heated:

- Thermal energy is transferred to the molecules the substance.
- Then, the molecules gain thermal energy and move faster and this causes :
  - The total kinetic energy of the molecules increases.
  - The temperature of substance increases.

عند تسخين المادة:

- يتم نقل الطاقة الحرارية إلى جزيئات المادة.
- ثم تكتسب الجزيئات طاقة حرارية وتتحرك بشكل أسرع وهذا يسبب:
  - تزداد الطاقة الحركية الكلية للجزيئات.
  - ترتفع درجة حرارة المادة .



Change state of matter

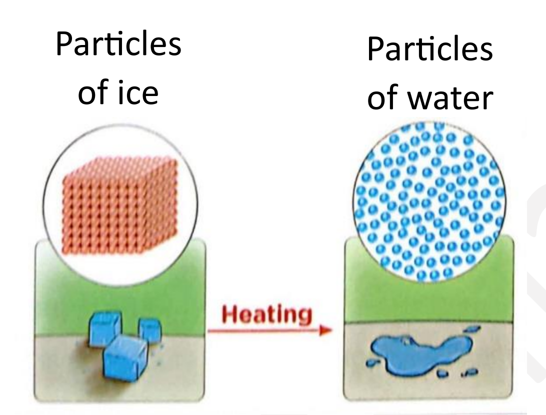
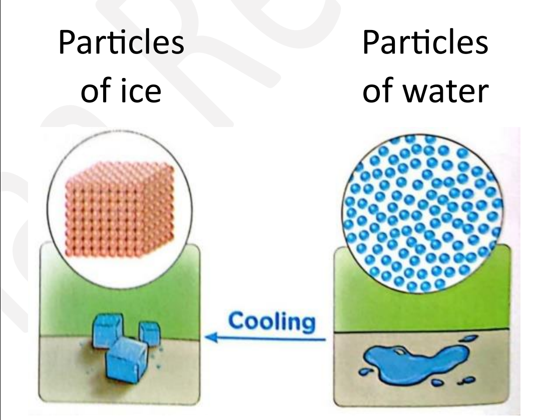
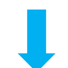
- When the thermal energy of a matter increases, the kinetic energy of its molecules increases and they move with faster **speed**, this leads to increase the temperature of a matter.
- At certain temperatures, when the thermal energy of a matter changes, the matter will change from one state to another.

- عندما تزيد الطاقة الحرارية للمادة، تزداد الطاقة الحركية لجزيئاتها وتتحرك **بسرعة** أكبر، مما يؤدي إلى زيادة درجة حرارة المادة.
- عند درجات حرارة معينة، عندما تتغير الطاقة الحرارية للمادة، تتغير المادة من حالة إلى أخرى.

The following table shows the changes from solid state to liquid state and the opposite change from liquid state to solid state at certain temperatures:

الجدول التالي يوضح التغيرات من الحالة الصلبة إلى الحالة السائلة والتغير المعاكس من الحالة السائلة إلى الحالة الصلبة عند درجات حرارة معينة:

Change from solid to liquid state "Melting"	Change from liquid to solid state "Freezing"
Melting: It is the change of state of matter from solid state to liquid state. On heating a solid matter. The thermal energy of molecules of solid matter **increases**. ⬇	***Freezing:*** It is the change of state of matter from liquid state to solid state. On cooling a liquid matter. The thermal energy of molecules of liquid matter **decreases**. ⬇

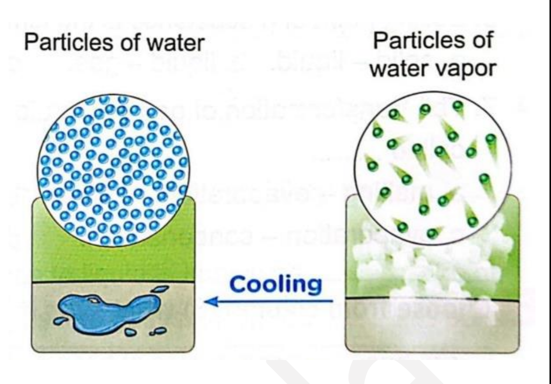
The force that holds these molecules together **decreases** so, they vibrate **faster**.  Molecules start to move away from each other, so the solid matter changes to liquid matter and this process is called "**melting**" ***Example:*** Ice changes to water. Particles of ice — Particles of water  **التحول من الحالة الصلبة إلى الحالة السائلة "الانصهار"** **الانصهار:** هو تغير حالة المادة من الحالة الصلبة إلى الحالة السائلة. ▪ عند تسخين مادة صلبة. **تزداد** الطاقة الحرارية لجزيئات المادة الصلبة.  **تتناقص** القوة التي تربط هذه الجزيئات معًا، لذا فإنها تهتز بشكل **أسرع**.	The force that holds these molecules together **increases** so, they vibrate **slower**.  Molecules start to get close together so, the liquid matter changes to solid matter and this process is called "**freezing**" ***Example:*** Water changes to ice. Particles of ice — Particles of water  **التحول من الحالة السائلة إلى الحالة الصلبة "التجمد"** **التجمد:** هو تغير حالة المادة من الحالة السائلة إلى الحالة الصلبة. ▪ عند تبريد مادة سائلة. **تنخفض** الطاقة الحرارية لجزيئات المادة السائلة.  **تزداد** القوة التي تربط هذه الجزيئات معًا، لذا فهي تهتز **أبطأ**. 

تبدأ الجزيئات بالابتعاد عن بعضها البعض، فتتحول المادة الصلبة إلى مادة سائلة وتسمى هذه العملية "**الانصهار**" **<u>مثال:</u>** تحول الجليد إلى ماء.	تبدأ الجزيئات بالتقارب من بعضها البعض فتتحول المادة السائلة إلى مادة صلبة وتسمى هذه العملية "**التجمد**" **<u>مثال:</u>** تحول الماء إلى ثلج .

The following table shows the change from liquid state into gas state and the opposite change from gas state to liquid state at certain temperatures:

Change from liquid to gas state "Evaporation"	**Change from gas to liquid state "Condensation"**
<u>Evaporation (vaporization):</u> It is the change of state of matter from liquid state to gas state. - On heating a liquid matter. The thermal energy of molecules of liquid matter **increases**.  The force that holds these molecules together **decreases** so, they vibrate **more faster**.  Molecules start to move away from each other, so the liquid matter vaporizes into gas matter and this process is called "**Evaporation**"	***<u>Condensation:</u>*** It is the change of state of matter from gas state to liquid state. - On cooling a gas matter. The thermal energy of molecules of gas matter **decreases**.  The force that holds these molecules together **increases** so, they vibrate **slower**.  Molecules start to get close together so, the gas matter changes to liquid matter and this process is called "**Condensation**"

Example: Water vapor changes to water.



التحول من الحالة الغازية إلى الحالة السائلة "التكثيف"

التكثيف:

هو تغير حالة المادة من الحالة الغازية إلى الحالة السائلة.

- عند تبريد مادة غازية.

تنخفض الطاقة الحرارية لجزيئات المادة الغازية.



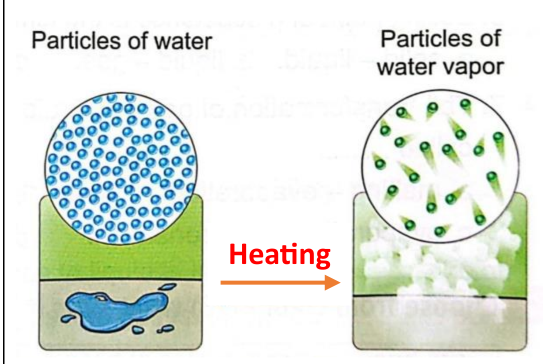
تزداد القوة التي تربط هذه الجزيئات معًا، لذا فهي تهتز **أبطأ**.



تبدأ الجزيئات بالتقارب من بعضها البعض فتتحول المادة السائلة إلى مادة صلبة وتسمى هذه العملية "**التكثيف**"

مثال: تحول بخار الماء إلى ماء .

Example: Water changes to water vapor.



التحول من الحالة السائلة إلى الحالة الغازية "التبخير"

التبخير:

هو تغير حالة المادة من الحالة السائلة إلى الحالة الغازية.

- عند تسخين مادة سائلة.

تزداد الطاقة الحرارية لجزيئات المادة السائلة.



تتناقص القوة التي تربط هذه الجزيئات معًا، لذا فإنها تهتز بشكل **أسرع**.



تبدأ الجزيئات بالابتعاد عن بعضها البعض، فتتحول المادة الصلبة إلى مادة سائلة وتسمى هذه العملية "**التبخير**"

مثال: تحول الماء إلى بخار ماء.

Lesson 3

Temperature and particle movement

In this activity, we will do an experiment that shows how the temperature affects the kinetic energy and the motion of molecules of matter through observing how quickly red dye will spread out in hot and cold water.

في هذا النشاط سنقوم بتجربة توضح كيفية تأثير درجة الحرارة على الطاقة الحركية وحركة جزيئات المادة من خلال ملاحظة مدى سرعة انتشار الصبغة الحمراء في الماء الساخن والبارد.

Tools:



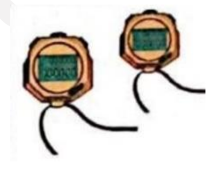
Beaker contains 100 ml of hot water
كوب يحتوي على 100 مل من الماء الساخن



Beaker contains 100 ml of cold water
كوب يحتوي على 100 مل من الماء البارد



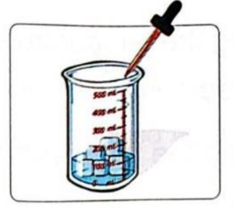
Two eyedroppers contains red dye
قطرتان تحتويان على صبغة حمراء



Two stopwatches
ساعتان إيقاف

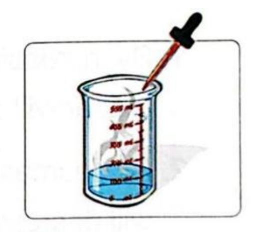
Steps:

1. Add two drops of the red dye to the center of each beaker at the same time.





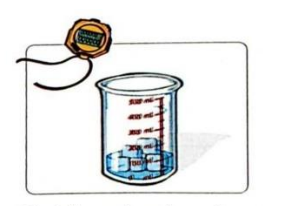
Cold water beaker

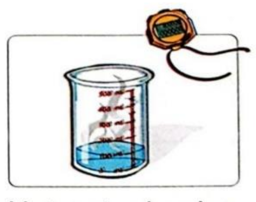


Hot water beaker

أضف قطرتين من الصبغة الحمراء إلى وسط كل كوب في نفس الوقت.

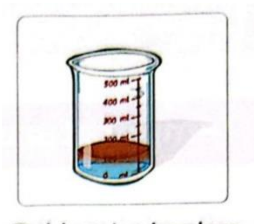
2. Start the two stopwatches at the time that the drops of red dye added to each beaker.

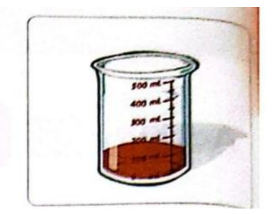

Cold water beaker


Hot water beaker

ابدأ تشغيل الساعتين في الوقت الذي تضاف فيه قطرات الصبغة الحمراء إلى كل كوب.

3. Record the time that the drops of the red dye take to completely spread out all over the water in each beaker.


Cold water beaker


Hot water beaker

سجل الوقت الذي تستغرقه قطرات الصبغة الحمراء لتنتشر بالكامل على الماء في كل كوب.



Observation:

- The red dye spreads out faster in the hot water beaker than the cold water beaker.

تنتشر الصبغة الحمراء في كوب الماء الساخن بشكل أسرع من كوب الماء البارد.

Conclusions:

1) In hot water beaker:

- The hot water has more thermal energy, so molecules of hot water have more kinetic energy and move faster.
- So, this causes the red dye takes less time to spread out in the hot water.

2) In cold water beaker:

- The cold water has less thermal energy, so molecules of cold water have less kinetic energy and move slower.

So, this causes the red dye takes more time to spread out in the cold water.

الاستنتاجات:

1- في كوب الماء الساخن:

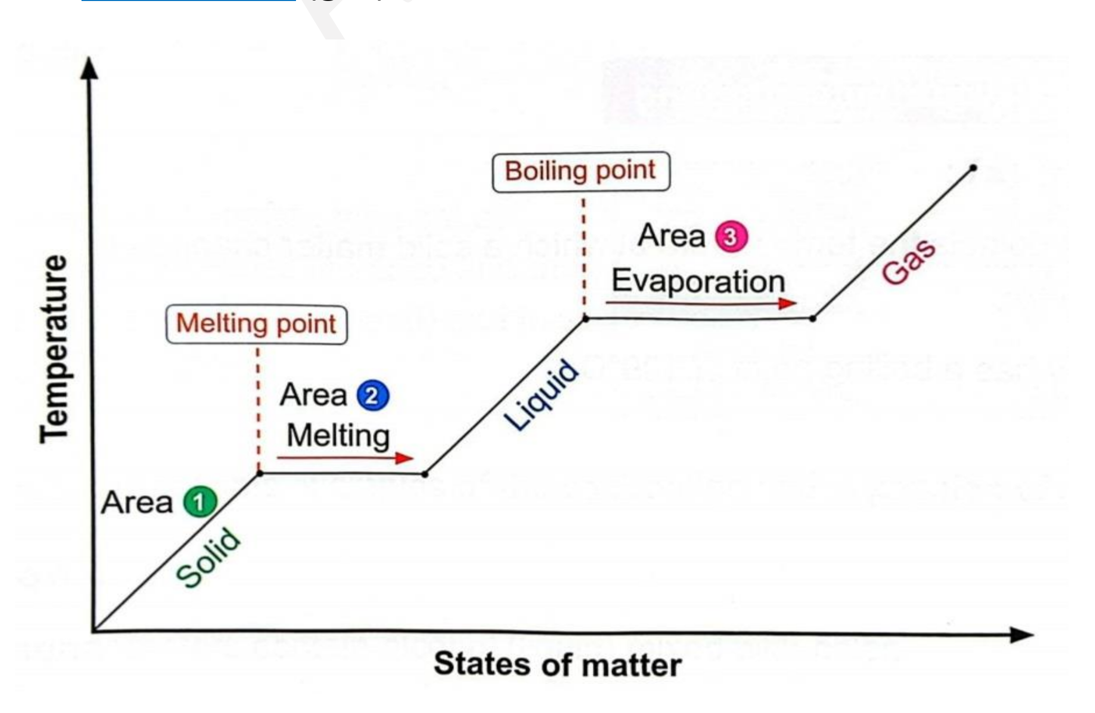
- يتمتع الماء الساخن بطاقة حرارية أكبر، لذا فإن جزيئات الماء الساخن تتمتع بطاقة حركية أكبر وتتحرك بشكل أسرع.
- وهذا يجعل الصبغة الحمراء تستغرق وقتًا أقل لتنتشر في الماء الساخن.

2- في كوب الماء البارد:

- يمتلك الماء البارد طاقة حرارية أقل، لذا فإن جزيئات الماء البارد تمتلك طاقة حركية أقل وتتحرك بشكل أبطأ.
- وهذا يجعل الصبغة الحمراء تستغرق وقتًا أطول لتنتشر في الماء البارد.

Lesson 4 ***thermal energy and particle movement***

The following graph shows the different processes that happen when a beaker of ice cubes was heated until the ice (solid) changes to water (liquid), then water (liquid) changes to water vapor (gas).



❖ At area (1), When the ice is heated, the molecules of ice absorb thermal energy and they move faster due to the increase of their kinetic energy.

❖ At area (2), By increasing the temperature, the kinetic energy of ice molecules increases that leads to decrease the force that bonds the molecules of ice together, so they slide over each other and ice (solid) changes to water (liquid), this temperature is called "***melting point***".

Melting point:
It is the temperature at which a matter changes from solid state to liquid state.

❖ At area (3), By increasing the temperature the force that holds the molecules together becomes more weak and they spread in all directions, so water (liquid) changes to water (gas vapor) and this temperature is called "***boiling point***".

Boiling point:
It is the temperature at which a matter changes from liquid state to gas state.

The melting point and boiling point are physical properties of matter.

Examples:

- Ice has a melting point of zero degree (0°C).
- Water has a boiling point of 100°C.
- Mercury has a boiling point of 357°C.

- الرسم البياني التالي يوضح العمليات المختلفة التي تحدث عند تسخين كوب به مكعبات ثلج حتى يتحول **الثلج** (الصلب) إلى **ماء** (سائل)، ثم يتحول الماء (السائل) إلى ماء (سائل) **بخار الماء** (الغاز).
  - **في المنطقة(1)،** عندما يسخن الجليد، تمتص جزيئات الجليد الطاقة الحرارية وتتحرك بشكل أسرع بسبب زيادة طاقتها الحركية.
  - **في المنطقة (2)،** بزيادة درجة الحرارة، تزداد *الطاقة* الحركية لجزيئات الجليد مما يؤدي إلى انخفاض القوة التي تربط جزيئات الجليد ببعضها، فتنزلق فوق بعضها البعض ويتحول الجليد (الصلب) إلى ماء (سائل)، هذه درجة الحرارة تسمى "**نقطة الانصهار**".

نقطة الانصهار:

هي درجة الحرارة التي تتحول عندها المادة من الحالة الصلبة إلى الحالة السائلة.

  - **في المنطقة(3)،** وبزيادة درجة الحرارة تصبح القوة التي تربط الجزيئات ببعضها أضعف وتنتشر في كل الاتجاهات، فيتحول الماء (السائل) إلى ماء (بخار الغاز) وتسمى درجة الحرارة هذه "**نقطة الغليان**".

نقطة الغليان:

هي درجة الحرارة التي تتحول عندها المادة من الحالة السائلة إلى الحالة الغازية.

- نقطة الانصهار ونقطة الغليان هي الخصائص الفيزيائية للمادة.

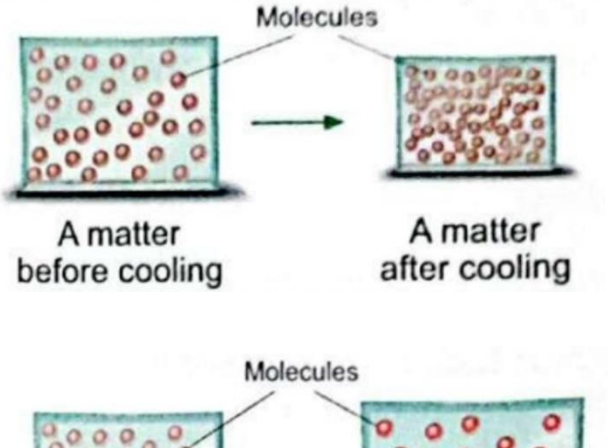
أمثلة:

- الجليد له نقطة انصهار تبلغ صفر درجة (0 درجة مئوية).
- درجة غليان الماء 100 درجة مئوية.
- درجة غليان الزئبق هي 357 درجة مئوية.

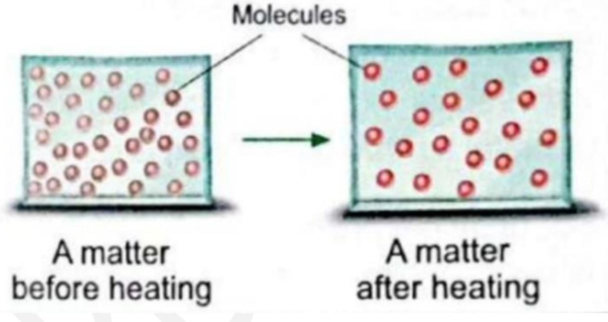
Thermal expansion

- ***Matter behave differently when they are heated or cooled, where :***

- When we cool a matter, the spaces between its molecules decrease and the molecules come close together (contract) and this is called "***contraction***".



- When we heat a matter, the spaces between its molecules increase and the molecules spread out (expand) and this is called "***expansion***".

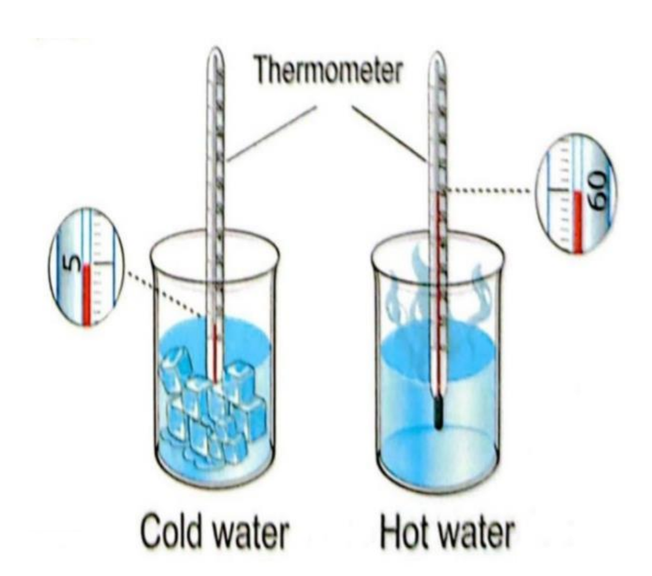


Some examples of the contraction and expansion of some matter:

Thermometer

- Some thermometers contain ***alcohol*** (liquid) mixed with color.

- When the thermometer is placed in ***hot substance***, the temperature of alcohol increases and the spaces between its molecules increase, so the molecules of alcohol spread out and ***expand*** giving high level of temperature in the thermometer.



- When the thermometer is placed in ***cold substance***, the temperature of alcohol decreases and the spaces between its molecules decrease, so the molecules of alcohol come close together and ***contract*** giving low level of temperature in the thermometer.

التمدد الحراري

- **المادة تتصرف بشكل مختلف عند تسخينها أو تبريدها، حيث:**
  - عندما نقوم بتبريد مادة ما فإن المسافات بين جزيئاتها تقل وتقترب الجزيئات من بعضها البعض (التقلص) وهذا ما يسمى "**الانكماش**".
  - عندما نقوم بتسخين مادة فإن الفراغات بين جزيئاتها تتزايد وتنتشر الجزيئات (تتوسع) وهذا ما يسمى "**التمدد**".

بعض الأمثلة على تقلص وتمدد بعض المواد:

مقياس الحرارة:

- تحتوي بعض موازين الحرارة على **كحول** (سائل) ممزوج بالألوان.
  - عند وضع الترمومتر في **مادة ساخنة** فإن درجة حرارة الكحول تزداد وتزداد المسافات بين جزيئاته، فتنتشر جزيئات الكحول **وتتوسع** مما يعطي درجة حرارة عالية في الترمومتر.
  - عند وضع الترمومتر في **مادة باردة** تنخفض درجة حرارة الكحول وتقل المسافات بين جزيئاته، فتتقارب جزيئات الكحول من بعضها البعض **وتتقلص** مما يؤدي إلى انخفاض درجة الحرارة في الترمومتر.

Jars

- Sometimes it is hard to open the lid of the jar.
- When you pour hot water on the lid of the jar, it opens easily, where:
  - The lid of the jar is made of **metal**.
  - When hot water is poured on the metal lid, the temperature of the metal lid increases and the spaces

between its molecules increase, so the molecules of metal lid spread out and expand, so it can be easily opened.

Bridges

- Bridges are made up of *steel* (metal) and *concrete*.
- When bridges are exposed to hot weather, the temperature of metal increases and the spaces between its molecules increase, so the molecules of metal spread out and expand.



So, engineers use ***expansion joints*** to keep bridges safe from buckling (bending) when they expand at high temperatures.

الجرة:

- في بعض الأحيان يكون من الصعب فتح غطاء الجرة.
- عند صب الماء الساخن على غطاء الجرة ينفتح بسهولة، حيث:
  - غطاء الجرة مصنوع من المعدن.
  - عند صب الماء الساخن على الغطاء المعدني، ترتفع درجة حرارة الغطاء المعدني وتزداد المسافات بين جزيئاته، فتنتشر جزيئات الغطاء المعدني وتتوسع، مما يسهل فتحه.

الجسور :

- الجسور تتكون من **الفولاذ** (المعدن) **والخرسانة**.
- عند تعرض الجسور للطقس الحار ترتفع درجة حرارة المعدن وتزداد المسافات بين جزيئاته، فتنتشر جزيئات المعدن وتتوسع.

لذلك يستخدم المهندسون **فواصل التمدد** للحفاظ على الجسور آمنة من الإلتواء (الانحناء) عند التمدد عند درجات حرارة عالية.

Lesson 5

Making a thermometer

In this activity, you will make a model of a thermometer.

ستقوم في هذا النشاط بصنع نموذج لمقياس الحرارة.

Tools:



Plastic bottle contains 50 ml of alcohol and 50 ml of water

زجاجة بلاستيكية تحتوي على 50 مل من الكحول و 50 مل من الماء



Plastic straw

الماصّة البلاستيكية



A bowl contains hot water

وعاء يحتوي على الماء الساخن



Clay

صلصال



A bowl contains cold water

وعاء يحتوي على الماء البارد



Eyedropper contains red dye

قطارة على صبغة حمراء

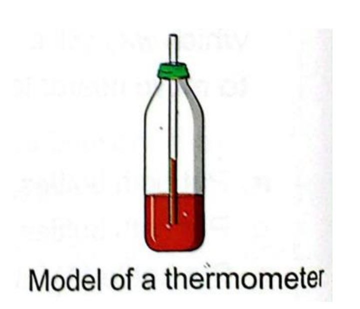
Steps:

1. Add three drops of the red dye in the plastic bottle.

أضف ثلاث قطرات من الصبغة الحمراء في الزجاجة البلاستيكية.

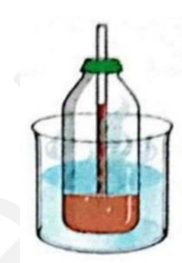


2. put the straw in the bottle and fix it by using the clay as shown, then measure the height of red liquid in the straw at room temperature.


Model of a thermometer

ضع الماصّة في الزجاجة وقم بتثبيتها باستخدام الطين كما هو موضح، ثم قم بقياس ارتفاع السائل الأحمر في الماصّة في درجة حرارة الغرفة.

3. Place the plastic bottle into a bowl of hot water and measure the height of the red liquid in the straw.



ضع الزجاجة البلاستيكية في وعاء من الماء الساخن وقم بقياس ارتفاع السائل الأحمر في الماصّة.



Observation:

- The height of the red liquid in the straw increases when the bottle is placed into the hot water.

يزداد ارتفاع السائل الأحمر في الماصّة عند وضع الزجاجة في الماء الساخن.

4. Place the plastic bottle into a bowl of cold water and measure the height of the red liquid in the straw.



ضع الزجاجة البلاستيكية في وعاء من الماء البارد وقم بقياس ارتفاع السائل الأحمر الموجود في الماصّة.



Observation:

- The height of the red liquid in the straw decreases when the plastic bottle is placed into the cold water.

يتناقص ارتفاع السائل الأحمر الموجود في الماصّة عند وضع الزجاجة البلاستيكية في الماء البارد.

Conclusions:

1) In a bowl of hot water:

- The temperature of red liquid increases, so the molecules of red liquid spread out and the spaces between them increase.
- This leads to the ***expansion*** of the molecules of red liquid and ***increase*** in the height of red liquid in the straw.

2) In a bowl of cold water:

- The temperature of red liquid decreases, so the molecules of red liquid come close together and the spaces between them decrease.
- This leads to the ***contraction*** of the molecules of red liquid and ***decrease*** in the height of red liquid in the straw.

الاستنتاجات:

1) في وعاء من الماء الساخن:

- تزداد درجة حرارة السائل الأحمر، فتنتشر جزيئات السائل الأحمر وتزداد المسافات بينها.
- يؤدي ذلك إلى **تمدد** جزيئات السائل الأحمر **وزيادة** ارتفاع السائل الأحمر في الماصّة.

2) في وعاء من الماء البارد:

- تنخفض درجة حرارة السائل الأحمر، فتتقارب جزيئات السائل الأحمر من بعضها وتقل المسافات بينها.

- يؤدي ذلك إلى **انقباض** جزيئات السائل الأحمر **وانخفاض** ارتفاع السائل الأحمر في الماصّة.

Increasing Thermal Energy

When a matter is heated:

- The thermal energy of matter increases, so the molecules of a matter move faster and their kinetic energy increases.
- So, the temperature of a matter increases.

زيادة الطاقة الحرارية

عندما تسخن المادة:

- تزداد الطاقة الحرارية للمادة، فتتحرك جزيئات المادة بشكل أسرع. وتزداد طاقتهم الحركية.
- وبالتالي ترتفع درجة حرارة المادة.

Lesson 6

- Engineers use some techniques to protect bridges and railroad tracks from expansion or contraction in different conditions of weather.

Examples:

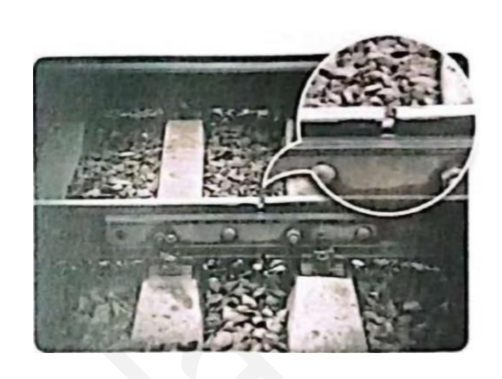
1 *In bridges*

- When the temperature increases in hot weather or decreases in cold weather, the metal that made up bridges expands and contracts.
- So, engineers use **expansion joints** to keep bridges safe over time.



Expansion joints

2 In railroad tracks



- Railroad tracks are made of **iron**.
- Engineers leave small spaces between the railroad tracks to allow these tracks to expand in hot weather without being **bent** to avoid train accidents.

- يستخدم المهندسون بعض التقنيات لحماية الجسور ومسارات السكك الحديدية من الانقباض أو الانكماش في الظروف الجوية المختلفة.

أمثلة:

1) في الجسور

- عندما ترتفع درجة الحرارة في الطقس الحار أو تنخفض في الطقس البارد، فإن المعدن الذي يتكون منه الجسور يتمدد وينكمش.
- لذلك، يستخدم المهندسون **فواصل التمدد** للحفاظ على سلامة الجسور مع مرور الوقت.

2) في مسارات السكك الحديدية

- مسارات السكك الحديدية مصنوعة من **الحديد**.
- يترك المهندسون مساحات صغيرة بين خطوط السكك الحديدية للسماح لهذه المسارات بالتوسع في الطقس الحار دون **انحناء** لتجنب حوادث القطارات.

Unit 2 – Concept 1

{ Thermal energy and States of matter }

Hot spring	ينبوع الماء الساخن	rocks	صخور
molten	المنصهر	rise	يرتفع
deep in earth	في أعماق الأرض	expansion	التمدد
glassblowing	تشكيل الزجاج	manufacturing	صناعة
glassware	الأواني الزجاجية	hollow	مجوّف
blow	ينفخ	molecule	جزيء
bound	يرتبط	atom	ذرة
tightly	بإحكام	loosely	بحرّية
independently	بشكل مستقل	moderate	متوسط
Thermal energy	طاقة حرارية	Kinetic energy	طاقة الحركة
transfer	ينتقل	sum	مجموع
melting	انصهار	freezing	تجمد
hold	يمسك	spread	ينتشر
Evaporation / vaporization	تبخير	condensation	تكثيف
dye	صبغة	stopwatch	ساعة إيقاف
eyedropper	قطّارة	beaker	وعاء مدرّج
absorb	يمتص	slide	ينزلق
techniques	تقنيات	bond	يربط
Melting point	درجة الانصهار	Boiling point	درجة الغليان
mercury	الزئبق	alcohol	الكحول

level	مستوى	contraction	الانكماش
behave	يسلك	lid	غطاء
Expansion joints	فواصل التمدد	Buckling / bending	انحناء
pour	يسكب	bowl	وعاء
fix	يتبّت	straw	ماصّة
height	ارتفاع	clay	صلصال
place	يضع	diagram	مخطط
conditions	حالات	Railroad tracks	خطوط السكك الحديدية
accidents	حوادث		

Unit 2 – concept 1 - questions

Lesson 1

Choose the correct answer:

1. The molecule is composed of very small particles called …………….
   a. cells b. atoms c. mixture d. compound

2. All of these substances are solids, except ……………
   a. pen b. balloon c. soup d. snow

3. Both …………….. and ………… are examples of liquid matter.
   a. water – milk c. water – copper
   b. water – wood d. oil - paper

4. Particles of all the following substances have a lot of energy, except ……………
   a. oxygen c. water vapor
   b. carbon dioxide d. glass

5. Thermal energy affects ……………. and ……………. of a matter.
   a. temperature – state c. color - taste
   b. temperature – color d. color – smell

6. The ……………… energy is related to the motion of particles of a matter.
   a. chemical b. potential c. light d. thermal

7. On boiling water inside a kettle, ………..
   a. water particles will move faster
   b. water particles will move slower
   c. thermal energy of water will decrease

d. thermal energy of water will not change

Choose from column (B) and (C) what suits them in column (A):

(A) Type of matter	(B) Example	(C) Its particles have …… energy
1. solid 2. Liquid 3. Gas	a. Steam b. Water c. Sound d. ice	A. high thermal B. no thermal C. low thermal D. moderate thermal

Put (√) or (x):

1- Matter can be changed from one state to another. ( )
2- Glass can be melt at very low temperatures. ( )
3- Almost all matter contains thermal energy. ( )
4- The movement of particles within an object is used to describe the thermal energy. ( )
5- Substances in gas form have the least thermal energy. ( )
6- All forms of matter are made of particles that are in a state of motion. ( )
7- Gases have variable shape and volume. ( )

Write the scientific term of each of the following:

- It is the smallest building unit of matter.

(…………………..)

- It is a group of atoms bound together.

(……………………….)

- The state of matter at which its particles have the most thermal energy. (………………………….)
- The state of matter that has fixed volume and shape.

(………………………….)

- The process of shaping a mass of molten glass by blowing air into it through a hollow tube. (…………………………….)

Complete the following sentences:

1) Matter consists of small building units called ………………..., which consist of smaller units called ....
2) Milk is a matter in .... state, while helium is a matter in ………………. state.
3) Water has .... volume and ……………... shape.
4) When butter melts, the speed of movement of its particles will ………………………….
5) As the speed of particles decreases, its thermal energy …………………………….
6) Particles of frozen chocolate have .... thermal energy than particles of molten chocolate.
7) The transfer of .... is called heat.

Give a reason for:

- Particles of steam have higher thermal energy than particles of water.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

What happens to …:

- ❖ The state of glass when it is heated at very high temperatures.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

Look at the opposite figure, then put (√) or (x):

(A) Label (2) refers to a state of matter in which its particles move very fast. (   )

(B) Label (1) refers to a state of matter in which its particles have the highest thermal energy. (   )

(C) At low temperatures, matter of label (3) may change into gas state. (   )

(D) Matter of label (1) has thermal energy more than that of matter of label (3). (   )

Lesson 2

Choose the correct answer:

1. When you touch a piece of ice, heat transfers from ……………… to ……………….
   a. ice - hand c. hand - ice
   b. ice - the body d. ice - air

2. Heat transfers from ……………….
   a. A cold object to an object that has the same temperature
   b. A hot object to an object that has the same temperature
   c. A cold object to a hot object
   d. A hot object to a cold object

3. Temperature is a measure of the ……………. energy of molecules of a substance.
   a. Kinetic b. potential c. light d. chemical

4. When the molecules of a substance gain thermal energy, their total kinetic energy ……………. and the temperature of substance …………………..
   a. decrease – decreases c. decrease - increases
   b. Increase – increases d. increase - decreases

5. Melting point of a substance is the temperature at which ………………. changes into ………………..
   a. solid - liquid c. gas – liquid
   b. liquid – gas d. liquid – solid

6. Boiling point of a substance is the temperature at which ………… changes into …………..
   a. solid – liquid
   b. liquid – gas
   c. gas – liquid
   d. liquid – solid

7. The transformation of gas into liquid is called ………. and the reverse process is called ………….
   a. melting – evaporation
   b. evaporation – melting
   c. evaporation - condensation
   d. condensation - evaporation

Choose from column (B) what suits it in column (A):

(A) Process	(B) Matter changes
1. melting 2. evaporation 3. freezing 4. condensation	a. from liquid to gas b. from solid to liquid c. from solid to gas d. from gas to liquid e. from liquid to solid

Put (√) or (x):

1- Heat flows from a hotter substance to a colder substance. ( )

2- If you hold a hot cup of tea with your hand, heat transfers from your hand to the cup. ( )

3- Molecules of solids move faster than molecules of liquids. ( )

4- By increasing the thermal energy of molecules of matter, the force that holds these molecules increases. ( )

5- The transformation of solid to liquid is called melting and the reverse process is called freezing. ( )

6- The melting point and boiling point of a substance are considered as physical properties of this substance. ( )

7- The boiling point of water is less than that of mercury. ( )

Write the scientific term of each of the following:

- It is a measure of the average kinetic energy of molecules and atoms of a substance. (………………………………)
- It is the change of matter from solid state to liquid state. (……………………………..)
- It is the change of matter from liquid state to gas state. (……………………………..)
- It is the change of matter from gas state to liquid state. (………………………………..)
- It is the change of matter from liquid state to solid state. (……………………………….)

Complete the following sentences:

1) Thermal energy of a substance is the total sum of …………………… energy of its molecules and atoms.
2) Thermal energy transfers from one substance to another if they have ……………………… temperatures.

3) The temperature at which solid changes to liquid is known as ……………………….. point.
4) The temperature at which liquid changes into gas is known as ……………………… point.
5) The process in which liquid changes into solid is called ………………………., and the reverse process is called …………………………….
6) Matter can change from liquid state to …………………. state at low temperatures, while it can change into …………………… high temperatures.
7) When the force that holds the molecules ………………, they vibrate faster, and when this force ……………………, they vibrate slower.
8) The ……………….. point and ………………… point are physical properties of matter.
9) The boiling point of water is …………………. than that of mercury.

Give reasons for:

- Ice melts when it is put in a hot cooking pan.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

- Matter may change from one state to another.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

- Evaporation and condensation are two opposite processes.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

<u>What happens when…:</u>

- You hold a piece of frozen chocolate in your hand. (According to transfer of heat).

……………………………………………………………………………………………….

……………………………………………………………………………………………….

- You touch a hot cup of tea. (According to transfer of heat).

……………………………………………………………………………………………….

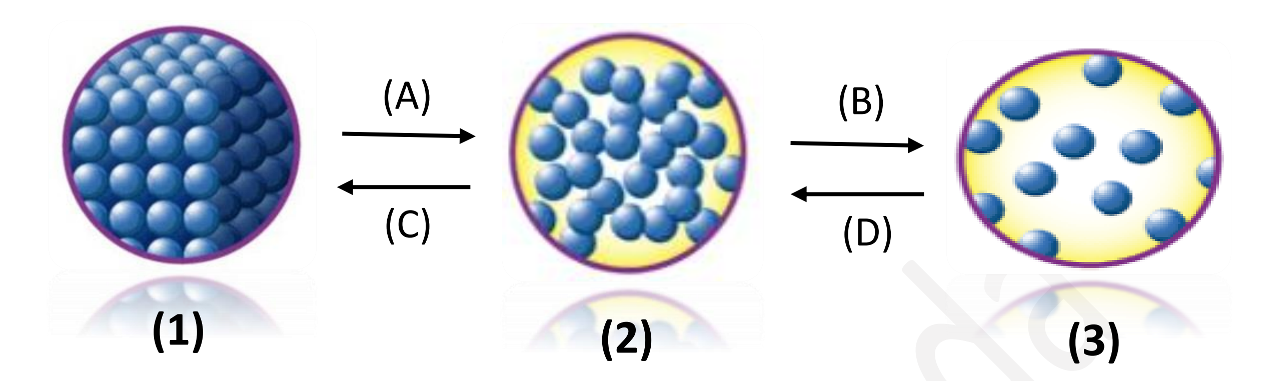
……………………………………………………………………………………………….

- You heat a piece of butter. (According to change of state).

……………………………………………………………………………………………….

……………………………………………………………………………………………….

Study the following figures that represents molecules of the three-state water then put (√) or (x):



- Process (B) is called evaporation, while process (C) is called freezing. (   )
- Water can be changed from state (2) to state (3) by cooling, while it can be changed from state (2) to state (1) by heating. (   )
- During process (A), the molecules absorb thermal energy and move faster. (   )
- During process (D), the force that holds molecules together decreases so, they vibrate slower. (   )

Lesson 3

Choose the correct answer:

1. Changing from gas to liquid is called ....
   a. melting c. condensation
   b. evaporation d. freezing

2. When wax melts, its particles ....
   a. gain thermal energy and speed up
   b. gain thermal energy and slow down

c. lose thermal energy and speed up
d. lose thermal energy and slow down

3. In which state(s) of matter are the molecules away from each other? …………….
   a. solid c. solid and liquid
   b. gas d. solid and gas

4. The state(s) of matter with the greatest amount of energy is/are …………………
   a. solid b. liquid c. gas d. solid and liquid

5. Water molecules have the lowest kinetic energy when it is in the form of …………………….
   a. Ice b. water drops c. water vapor d. steam

6. Changing ice into water followed by changing water into steam show two different processes which are ……………………. and ……………………………
   a. freezing – condensation
   b. evaporation – condensation
   c. melting - freezing
   d. melting - evaporation

7. Objects with more thermal energy have ………………… kinetic energy.
   a. more b. less c. the same d. no

Put (√) or (x):

1- When the temperature of a matter increases, its molecules move slower. ( )

2- Hot water molecules have more kinetic energy than cold water. ( )
3- Food coloring (dye) spreads out in cold water faster than in hot water. ( )
4- Temperature is a measure of the average kinetic energy of the molecules of a matter. ( )
5- By decreasing the thermal energy, the kinetic energy increases. ( )
6- Kinetic energy is the energy of motion. ( )

Write the scientific term of each of the following:

- A process in which liquid molecules move faster and change to another state. (………………………….)
- A process in which liquid molecules move slower and change to another state. (…………………………..)

Complete the following sentences:

1) Molecules of liquid matter can move more faster than molecules of …………………… matter and more slower than molecules of ……………… matter.
2) As temperature …………………, the kinetic energy of molecules increases.
3) When we keep water inside the freezer, the state of water changes from liquid to ………………….
4) A drop of food coloring added to a hot cup of water will spread out …………………… than in cold water.

5) The temperature at which molecules of water are heated and spread so far apart that the liquid becomes a gas is called …………………… point.

6) Changing of matter from ……………….. state to ……………….. state is called evaporation.

Give a reason for the following:

- Food coloring takes less time to spread out in the hot water than in cold water.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

What happens to…:

- The speed of molecules of a matter when it is heated.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Look at the opposite picture that represents wet clothes that are put on a washing line to dry, then put (√) or (x) in front of the following sentences:

1. Water in the clothes turns into water vapor in the air as they dry. ( )

2. Molecules of water in the clothes move slower after changing into water vapor. ( )

3. The change of state of water from liquid state to gas state is known as evaporation. ( )
4. The kinetic energy of water molecules is greater than that of water vapor molecules. ( )

Lesson 4

Choose the correct answer:

1. On a very hot summer morning, water on the ground may turn into water vapor, this change is called ....
   a. melting
   b. evaporation
   c. freezing
   d. condensation

2. Some thermometers contain a colored alcohol, what happens to alcohol when the thermometer is placed in hot water? ....
   a. alcohol contracts
   b. alcohol evaporates
   c. alcohol changes its color
   d. alcohol expands

3. When the temperature of a rod of iron is increased, ...
   a. its length increases
   b. its length decreases to its half
   c. its length doesn't change
   d. its length decreases to its quarter

4. When the temperature of alcohol inside thermometers increases, its volume ....
   a. increases causing its contraction
   b. decreases causing its expansion
   c. decreases causing its contraction

d. increases causing its expansion

5. As a result of heat flow through metals, they ……………….
   a. expand c. get smaller
   b. contract d. are not affected

6. Expansion joints are designed to allow concrete …………….
   When temperature …………….. to keep bridges safe from buckling.
   a. expands – decreases c. expands – doesn't change
   b. expands – increases d. contract – doesn't change

7. When a thermometer is placed in a cup of iced water, the liquid inside the thermometer ……….. due to its …………….
   a. goes down - expansion c. goes down – contraction
   b. rises up - expansion d. rises up - contraction

Put (√) or (x):

1- The decrease in volume of matter that occurs when matter is cooled is called expansion. ( )
2- When an object gains heat, its temperature increases, and its state may change. ( )
3- We can measure the temperature by using thermometers. ( )
4- The main idea to make a thermometer is changing the volume of liquid inside it according to the temperature. ( )
5- When a substance is cooled, its molecules come close together. ( )
6- If it is hard to open the lid of the jar, we need to pour cold water on the lid of the jar to open it easily. ( )
7- When objects lose heat, they contract. ( )

8- When a substance expands, its volume increases. ( )

Write the scientific term of each of the following:

- A device used to measure the temperature.

  (……………………………)

- The increase in the volume of a material as its temperature increases. (……………………………)
- The decrease is the volume of a material as its temperature decreases. (……………………………….)
- Joints between parts of a bridge that allow its expansion without being damaged. (……………………………….)

Complete the following sentences:

1) The increase in the volume of a matter that occurs when heating this matter is called ……………………
2) When we cool a matter, the spaces between its molecules ……………….. , but when we heat it, the spaces between its molecules ……………………….
3) When a substance is contracted, its volume …………………………… , while its volume increases when it is ………………..
4) By increasing the temperature of matter, the speed of its molecules ……………….. and the kinetic energy ………………

5) When bridges are exposed to ………………….. weather, the spaces between the molecules of expansion joints …………………… causing its expansion.
6) Engineers use …………………….. joints to keep bridges from buckling at high temperatures.
7) Different materials ……………………… by heating and ………………….. by cooling.

Give reasons for:

- Engineers use expansion points in the designing of bridges.

………………………………………………………………………………………………….

………………………………………………………………………………………………….

- The level of alcohol inside a thermometer rises up if we put it inside hot water and goes down if we put it inside cold water.

………………………………………………………………………………………………….

………………………………………………………………………………………………….

- Pouring hot water over a metal lid of a glass jar makes it easier to open the jar.

………………………………………………………………………………………………….

………………………………………………………………………………………………….

What happens to…:

- ❖ Bridges if engineers don't use expansion joints in their designing.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- ❖ The level of alcohol inside a thermometer if we put it inside hot water.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- ❖ The level of alcohol inside a thermometer if we put it inside cold water.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- ❖ The spaces between molecules of a matter if we heat it.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Look at the figure below that shows 2 empty glass bottles connected by a glass tube with a Ping-Pong ball in the tube:

- Without breaking the glass tube, which way will cause the small ball to move nearer to bottle B ? …………………

a. put both bottles (A) and (B) into a basin of cold water.
b. put both bottles (A) and (B) into a basin of hot water.
c. put bottle (A) into a basin of hot water and bottle (B) into a basin of cold water.
d. put bottle (A) into a basin of cold water and bottle (B) into a basin of hot water.

Lesson 5

Choose the correct answer:

1. During melting process, matter starts to change from …………………… state to …………………. state.
   a. solid – liquid c. liquid - gas
   b. liquid – solid d. solid - gas

2. The temperature ………………….. during the melting of solids.
   a. decreases c. does not change
   b. increases d. may increase or decrease

3. By decreasing the temperature of a substance, its molecules move …………………. each other and the spaces between them ………………..
   a. farther away – increase c. farther away - decrease
   b. nearer to – increase d. nearer to - decrease

4. By increasing the temperature of a substance, its molecules move ………………… each other and the spaces between them …………………
   a. farther away – increase c. farther away - decrease
   b. nearer to – increase d. nearer to - decrease

5. A metallic rod of 50 meter length was heated at high temperature, its length could reach ………… meter after heating.
   a. 47　　b. 48　　c. 49　　d. 51

6. Materials …………….. on heating. B. contract
   a. expand　　c. compress
   b. contract　　d. does not change

7. A tightly closed metal lid of a glass bottle can be opened more easily if it is put in …………. for some time.
   a. cold water　　c. cold vinegar
   b. iced water　　d. hot water

Put (√) or (x):

1- When the temperature of solids increases, their volume decrease. ( )
2- Substances change from liquid state into gas state during evaporation process. ( )
3- Spaces between molecules of a substance increase by decreasing the temperature of this substance. ( )
4- Expansion and contraction of matter occur due to changes in temperature. ( )
5- Expansion and contraction are two opposite processes. ( )
6- When a liquid is cooled, it may change into gas. ( )

Write the scientific term of each of the following:

- The state of matter which changes into liquid state by heating. (…………………………………)

- The state of matter which changes into liquid state by cooling. (…………………………………..)
- It is the increase of the size of a substance due to increasing of its temperature. (………………………………..)
- It is the decrease of the size of a substance due to decreasing of its temperature. (…………………………………)

<u>Complete the following sentences using the words below:</u>

(**expand – contract - faster – slower - increase - decrease - near to - away from - thermometer**)

1) Cooling causes matter to .... , and causes particles to move ……………………..
2) When a liquid is freezes, the spaces between its molecules …………………… causing their movement ………………….. each other.
3) Heating causes matter to ...., and causes particles to move ....
4) When a liquid is heated, the spaces between its molecules …………………….. causing their movement .... each other.
5) Expansion and contraction of liquids explain how a .... works.

Give reasons for:

- Matter expands when its thermal energy increases.

………………………………………………………………………………………………

………………………………………………………………………………………………

- The size of a balloon decreases if it is subjected to a cold weather.

………………………………………………………………………………………………

………………………………………………………………………………………………

What happens to...:

- ❖ The size of an inflated balloon if it is put in hot weather.

………………………………………………………………………………………………

………………………………………………………………………………………………

- ❖ The volume of matter when it is cooled.

………………………………………………………………………………………………

………………………………………………………………………………………………

Look at the figures below that show a metallic ball that can pass through the ring easily. When the ball is heated, the ball cannot pass through the same ring.

Complete the following sentences using the words below:

(**heat – cool - expansion – contraction – kinetic**)

1. When we …………………. the ball, the ……………………. energy of its molecules increases.
2. After heating the ball, the ball cannot pass as a result of its ……………………..
3. If we …………………. the ball, it can pass through the ring again as a result of its ……………………..

Lesson 6

Choose the correct answer:

1. Metallic parts of a bridge .... in different temperatures.
   a. expand only c. expand and contract
   b. contract only d. never expand or contract

2. When the kinetic energy of liquids decreases, they may ……………………..
   a. expand b. contract c. evaporate d. disappear

3. Railroad tracks are made up of …………………
   a. glass b. coal c. plastic d. iron

4. Engineers leave .... between railroad tracks.
   a. small spaces c. large spaces
   b. very large spaces d. no spaces

5. Materials .... by ……………. their temperatures.
   a. expand – decreasing c. contract - decreasing
   b. contract – increasing d. melt - decreasing

Put (√) or (x):

1- Engineers use expansion joints to keep bridges safe. ( )
2- Temperature increases in hot weather causing contraction of materials. ( )
3- Railroad tracks are made up of iron. ( )
4- No spaces are left between railroad tracks. ( )
5- Without leaving spaces between railroad tracks, train accidents may occur. ( )
6- Volume of metals increases during expansion and decreases during contraction. ( )

Write the scientific term of each of the following:

- Joints allow expansion and contraction of some parts of bridges during temperature changes.

  (……………………………..)

- Decreasing the volume of a substance as a result of decreasing its temperature.

  (………………………………)

- It is the state of matter that has a fixed shape and spaces between its molecules are very narrow.

  (……………………………….)

- It is the state that doesn't have fixed shape or volume.

  (……………………………….)

Complete the following sentences using the words below:

(**Increases – decreases – expand – contract – heating – cooling**)

1) When the temperature ………………… in hot weather, metallic parts of a bridge …………………
2) When the temperature ……………….. in cold weather, metallic parts of a bridge ……………………..
3) Metals expand by …………………… and contract by ……………………..

Give reasons for:

- Expansion joints are designed in bridges.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- Small spaces are left between the railroad tracks.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

What happens to …:

- Bridges if expansion joints are not designed.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

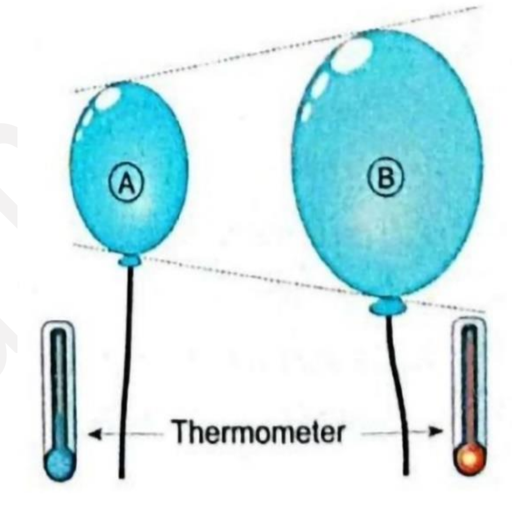
❖ The railroad tracks if no spaces are left between them.

…………………………………………………………………………………………………….

…………………………………………………………………………………………………….

<u>Look at the picture below that shows 2 similar inflated balloons A and B, If one of them is placed in a low temperature place and the other is placed in a higher temperature place.</u>

<u>Put (√) or (x):</u>



1. Molecules of air move in balloon (A) faster than in balloon (B). ( )
2. Spaces between molecules of air in balloon (B) are greater than that of air in balloon (A). ( )
3. Air expands in balloon (A) and contracts in balloon (B). ( )

Unit 2 – concept 1 - answers

Lesson 1

Choose the correct answer:

1. The molecule is composed of very small particles called …………….
   a. cells **b. atoms** c. mixture d. compound

2. All of these substances are solids, except ……………
   a. pen b. balloon **c. soup** d. snow

3. Both …………….. and ……….. are examples of liquid matter.
   a. water – milk c. water – copper
   b. water – wood d. oil - paper

4. Particles of all the following substances have a lot of energy, except ……………
   a. oxygen c. water vapor
   b. carbon dioxide **d. glass**

5. Thermal energy affects ……………. and ……………. of a matter.
   a. temperature – state c. color - taste
   b. temperature – color d. color – smell

6. The ……………… energy is related to the motion of particles of a matter.
   a. chemical b. potential c. light **d. thermal**

7. On boiling water inside a kettle, ………..
   a. water particles will move faster
   b. water particles will move slower
   c. thermal energy of water will decrease

d. thermal energy of water will not change

Choose from column (B) and (C) what suits them in column (A):

(A) Type of matter	(B) Example	(C) Its particles have …… energy
1. solid **d → C** 2. Liquid **b → D** 3. Gas **a → A**	a. Steam b. Water c. Sound d. ice	A. high thermal B. no thermal C. low thermal D. moderate thermal

Put (√) or (x):

1- Matter can be changed from one state to another. (**√**)
2- Glass can be melt at very low temperatures. (**X**)
3- Almost all matter contains thermal energy. (**√**)
4- The movement of particles within an object is used to describe the thermal energy. (**√**)
5- Substances in gas form have the least thermal energy. (**X**)
6- All forms of matter are made of particles that are in a state of motion. (**√**)
7- Gases have variable shape and volume. (**√**)

Write the scientific term of each of the following:

- It is the smallest building unit of matter. (**atom**)
- It is a group of atoms bound together. (**molecule**)
- The state of matter at which its particles have the most thermal energy. (**gas**)
- The state of matter that has fixed volume and shape.

(**solid**)

- The process of shaping a mass of molten glass by blowing air into it through a hollow tube. (**glassblowing**)

Complete the following sentences:

1) Matter consists of small building units called **molecules**, which consist of smaller units called **atoms**.
2) Milk is a matter in **liquid** state, while helium is a matter in **gas** state.
3) Water has **fixed** volume and **variable** shape.
4) When butter melts, the speed of movement of its particles will **increase**.
5) As the speed of particles decreases, its thermal energy **decreases**.
6) Particles of frozen chocolate have **less** thermal energy than particles of molten chocolate.
7) The transfer of **thermal energy** is called heat.

Give a reason for:

- Particles of steam have higher thermal energy than particles of water.
  - **Because particles of steam move faster than particles of water.**

What happens to ...:

- The state of glass when it is heated at very high temperatures.
  - **It changes from solid state into liquid state.**

Look at the opposite figure, then put (√) or (x):

(A) Label (2) refers to a state of matter in which its particles move very fast. (X)

(B) Label (1) refers to a state of matter in which its particles have the highest thermal energy. (√)

(1)

(2)

(3)

(C) At low temperatures, matter of label (3) may change into gas state. (X)

(D) Matter of label (1) has thermal energy more than that of matter of label (3). (√)

Lesson 2

Choose the correct answer:

1. When you touch a piece of ice, heat transfers from ……………… to ……………….
   a. ice - hand
   b. ice - the body
   c. hand - ice
   d. ice - air

2. Heat transfers from ……………….
   a. A cold object to an object that has the same temperature
   b. A hot object to an object that has the same temperature
   c. A cold object to a hot object
   d. A hot object to a cold object

3. Temperature is a measure of the ……………… energy of molecules of a substance.
   a. Kinetic b. potential c. light d. chemical

4. When the molecules of a substance gain thermal energy, their total kinetic energy ……………… and the temperature of substance …………………..
   a. decrease – decreases c. decrease - increases
   b. increase – increases d. increase - decreases

5. Melting point of a substance is the temperature at which ………………. changes into ……………….
   a. solid - liquid c. gas – liquid
   b. liquid – gas d. liquid – solid

6. Boiling point of a substance is the temperature at which ………… changes into ………….
   a. solid – liquid c. gas – liquid
   b. liquid – gas d. liquid – solid

7. The transformation of gas into liquid is called ………. and the reverse process is called ………….
   a. melting – evaporation c. evaporation - condensation
   b. evaporation – melting d. condensation - evaporation

Choose from column (B) what suits it in column (A):

(A) Process		(B) Matter changes
1. Melting	b	a. from liquid to gas
2. Evaporation	a	b. from solid to liquid
3. Freezing	e	c. from solid to gas
4. Condensation	d	d. from gas to liquid
		e. from liquid to solid

Put (√) or (x):

1- Heat flows from a hotter substance to a colder substance. (√)

2- If you hold a hot cup of tea with your hand, heat transfers from your hand to the cup. (X)

3- Molecules of solids move faster than molecules of liquids. (X)

4- By increasing the thermal energy of molecules of matter, the force that holds these molecules increases. (X)

5- The transformation of solid to liquid is called melting and the reverse process is called freezing. (√)

6- The melting point and boiling point of a substance are considered as physical properties of this substance. (√)

7- The boiling point of water is less than that of mercury. (√)

Write the scientific term of each of the following:

- It is a measure of the average kinetic energy of molecules and atoms of a substance. (**Thermal energy**)
- It is the change of matter from solid state to liquid state. (**melting**)
- It is the change of matter from liquid state to gas state.

(**evaporation**)

- It is the change of matter from gas state to liquid state.

(**condensation**)

- It is the change of matter from liquid state to solid state.

(**freezing**)

Complete the following sentences:

1) Thermal energy of a substance is the total sum of **kinetic** energy of its molecules and atoms.
2) Thermal energy transfers from one substance to another if they have **different** temperatures.
3) The temperature at which solid changes to liquid is known as **melting** point.
4) The temperature at which liquid changes into gas is known as **boiling** point.
5) The process in which liquid changes into solid is called **freezing**, and the reverse process is called **melting**.
6) Matter can change from liquid state to **solid** state at low temperatures, while it can change into **gas** high temperatures.
7) When the force that holds the molecules **decreases**, they vibrate faster, and when this force **increases**, they vibrate slower.
8) The **melting** point and **boiling** point are physical properties of matter.
9) The boiling point of water is **less** than that of mercury.

Give reasons for:

- Ice melts when it is put in a hot cooking pan.
  - **Because heat flows from the hotter substance (pan) to the colder substance (ice).**

- Matter may change from one state to another.
  - **Because the thermal energy of a matter may change, causing a change in the state of matter.**

- Evaporation and condensation are two opposite processes.
  - **Because matter changes from liquid state into gas state in evaporation, while it changes from gas state into liquid state in condensation.**

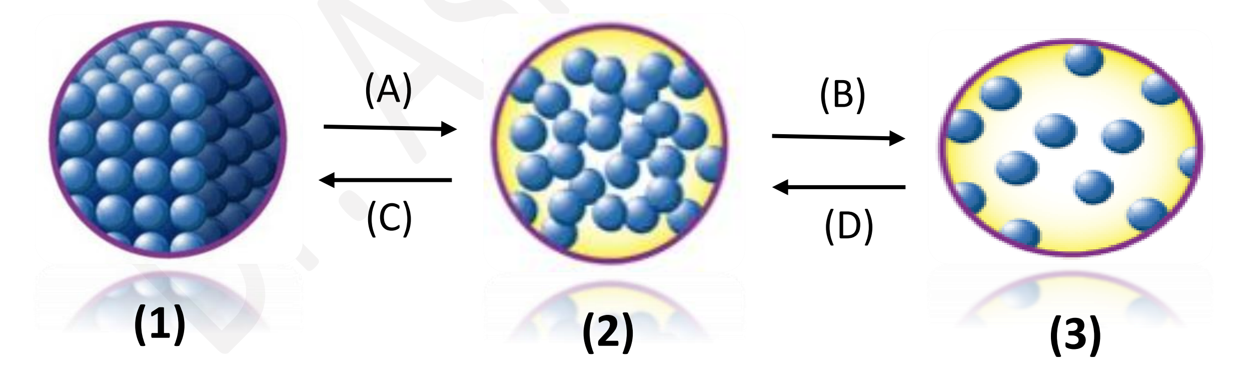
What happens when…:

- You hold a piece of frozen chocolate in your hand. (According to transfer of heat).
  - **Heat transfers from the hand to the chocolate.**

- You touch a hot cup of tea. (According to transfer of heat).
  - **Heat transfers from the cup to the hand.**

- You heat a piece of butter. (According to change of state).
  - **It changes from solid state into liquid state.**

Study the following figures that represents molecules of the three-state water then put (√) or (x):



- Process (B) is called evaporation, while process (C) is called freezing. (**√**)
- Water can be changed from state (2) to state (3) by cooling, while it can be changed from state (2) to state (1) by heating. (**X**)
- During process (A), the molecules absorb thermal energy and move faster. (**√**)

- During process (D), the force that holds molecules together decreases so, they vibrate slower. (X)

Lesson 3

Choose the correct answer:

1. Changing from gas to liquid is called …………………..
   a. melting   c. condensation
   b. evaporation   d. freezing

2. When wax melts, its particles ……………………
   a. gain thermal energy and speed up
   b. gain thermal energy and slow down
   c. lose thermal energy and speed up
   d. lose thermal energy and slow down

3. In which state(s) of matter are the molecules away from each other? ……………
   a. solid   c. solid and liquid
   b. gas   d. solid and gas

4. The state(s) of matter with the greatest amount of energy is/are …………………
   a. solid   b. liquid   c. gas   d. solid and liquid

5. Water molecules have the lowest kinetic energy when it is in the form of ……………………
   a. ice   b. water drops   c. water vapor   d. steam

6. Changing ice into water followed by changing water into steam show two different processes which are …………………… and ……………………………

a. freezing – condensation
b. evaporation – condensation
c. melting - freezing
d. melting - evaporation

7. Objects with more thermal energy have ………………… kinetic energy.
   a. more b. less c. the same d. no

Put (√) or (x):

1- When the temperature of a matter increases, its molecules move slower. (**X**)
2- Hot water molecules have more kinetic energy than cold water. (**√**)
3- Food coloring (dye) spreads out in cold water faster than in hot water. (**X**)
4- Temperature is a measure of the average kinetic energy of the molecules of a matter. (**√**)
5- By decreasing the thermal energy, the kinetic energy increases. (**X**)
6- Kinetic energy is the energy of motion. (**√**)

Write the scientific term of each of the following:

- A process in which liquid molecules move faster and change to another state. (**evaporation**)
- A process in which liquid molecules move slower and change to another state. (**freezing**)

Complete the following sentences:

1) Molecules of liquid matter can move more faster than molecules of **solid** matter and more slower than molecules of **gas** matter.

2) As temperature **increases**, the kinetic energy of molecules increases.
3) When we keep water inside the freezer, the state of water changes from liquid to **solid**.
4) A drop of food coloring added to a hot cup of water will spread out **faster** than in cold water.
5) The temperature at which molecules of water are heated and spread so far apart that the liquid becomes a gas is called **boiling** point.
6) Changing of matter from **liquid** state to **gas** state is called evaporation.

Give a reason for the following:

- Food coloring takes less time to spread out in the hot water than in cold water.
  - **Because hot water has more thermal energy, so its molecules have more kinetic energy and move faster.**

What happens to…:

- The speed of molecules of a matter when it is heated.
  - **It will increase.**

Look at the opposite picture that represents wet clothes that are put on a washing line to dry, then put (√) or (x) in front of the following sentences:



1. Water in the clothes turns into water vapor in the air as they dry. (**√**)
2. Molecules of water in the clothes move slower after changing into water vapor. (**X**)

3. The change of state of water from liquid state to gas state is known as evaporation. (√)
4. The kinetic energy of water molecules is greater than that of water vapor molecules. (X)

Lesson 4

Choose the correct answer:

1. On a very hot summer morning, water on the ground may turn into water vapor, this change is called ....
   - a. melting
   - **b. evaporation**
   - c. freezing
   - d. condensation

2. Some thermometers contain a colored alcohol, what happens to alcohol when the thermometer is placed in hot water? ....
   - a. alcohol contracts
   - b. alcohol evaporates
   - c. alcohol changes its color
   - **d. alcohol expands**

3. When the temperature of a rod of iron is increased, ...
   - **a. its length increases**
   - b. its length decreases to its half
   - c. its length doesn't change
   - d. its length decreases to its quarter

4. When the temperature of alcohol inside thermometers increases, its volume ....
   - a. increases causing its contraction
   - b. decreases causing its expansion
   - c. decreases causing its contraction
   - **d. increases causing its expansion**

5. As a result of heat flow through metals, they ……………….
   a. expand
   c. get smaller
   b. contract
   d. are not affected

6. Expansion joints are designed to allow concrete ……………. When temperature ……………… to keep bridges safe from buckling.
   a. expands – decreases
   c. expands – doesn't change
   b. expands – increases
   d. contract – doesn't change

7. When a thermometer is placed in a cup of iced water, the liquid inside the thermometer ……….. due to its …………….
   a. goes down - expansion
   c. goes down – contraction
   b. rises up - expansion
   d. rises up - contraction

Put (√) or (x):

1- The decrease in volume of matter that occurs when matter is cooled is called expansion. (X)
2- When an object gains heat, its temperature increases, and its state may change. (√)
3- We can measure the temperature by using thermometers. (√)
4- The main idea to make a thermometer is changing the volume of liquid inside it according to the temperature. (√)
5- When a substance is cooled, its molecules come close together. (√)
6- If it is hard to open the lid of the jar, we need to pour cold water on the lid of the jar to open it easily. (X)
7- When objects lose heat, they contract. (√)
8- When a substance expands, its volume increases. (√)

Write the scientific term of each of the following:

- A device used to measure the temperature. (**thermometer**)
- The increase in the volume of a material as its temperature increases. (**expansion**)
- The decrease is the volume of a material as its temperature decreases. (**contraction**)
- Joints between parts of a bridge that allow its expansion without being damaged. (**expansion joints**)

Complete the following sentences:

1) The increase in the volume of a matter that occurs when heating this matter is called **expansion**.
2) When we cool a matter, the spaces between its molecules **decrease** , but when we heat it, the spaces between its molecules **increase**.
3) When a substance is contracted, its volume **decreases**, while its volume increases when it is **expanded**.
4) By increasing the temperature of matter, the speed of its molecules **increases** and the kinetic energy **increases**.
5) When bridges are exposed to **hot** weather, the spaces between the molecules of expansion joints **increase** causing its expansion.
6) Engineers use **expansion** joints to keep bridges from buckling at high temperatures.
7) Different materials **expand** by heating and **contract** by cooling.

Give reasons for:

- Engineers use expansion points in the designing of bridges.
  - **To keep bridges safe from buckling when they expand at high temperatures.**

- The level of alcohol inside a thermometer rises up if we put it inside hot water and goes down if we put it inside cold water.
  - **Because alcohol expands by heating and contracts by cooling.**

- Pouring hot water over a metal lid of a glass jar makes it easier to open the jar.
  - **Because when the temperature of the metal lid increases, it expands and can be easily opened.**

<u>What happens to...:</u>

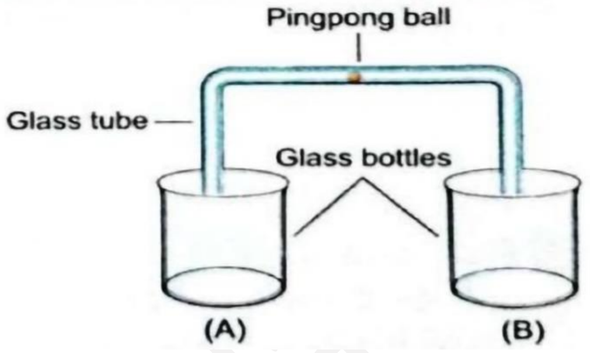
- Bridges if engineers don't use expansion joints in their designing.
  - **Buckling of bridges occurs as a result of expansion at high temperatures.**

- The level of alcohol inside a thermometer if we put it inside hot water.
  - **It will rise up.**

- The level of alcohol inside a thermometer if we put it inside cold water.
  - **It will go down.**

- The spaces between molecules of a matter if we heat it.
  - **It will increase.**

Look at the figure below that shows 2 empty glass bottles connected by a glass tube with a Ping-Pong ball in the tube:



- Without breaking the glass tube, which way will cause the small ball to move nearer to bottle B ? ………………….

a. put both bottles (A) and (B) into a basin of cold water.
b. put both bottles (A) and (B) into a basin of hot water.
c. put bottle (A) into a basin of hot water and bottle (B) into a basin of cold water.
d. put bottle (A) into a basin of cold water and bottle (B) into a basin of hot water.

Lesson 5

Choose the correct answer:

1. During melting process, matter starts to change from …………………… state to …………………. state.
   a. solid – liquid c. liquid - gas
   b. liquid – solid d. solid - gas

2. The temperature …………………… during the melting of solids.
   a. decreases c. does not change
   b. increases d. may increase or decrease

3. By decreasing the temperature of a substance, its molecules move …………………. each other and the spaces between them …………………
   a. farther away – increase c. farther away - decrease

b. nearer to – increase   d. nearer to - decrease

4. By increasing the temperature of a substance, its molecules move ………………… each other and the spaces between them …………………
   a. farther away – increase   c. farther away - decrease
   b. nearer to – increase   d. nearer to - decrease

5. A metallic rod of 50 meter length was heated at high temperature, its length could reach ……….. meter after heating.
   a. 47   b. 48   c. 49   d. 51

6. Materials ……………. on heating. B. contract
   a. expand   c. compress
   b. contract   d. does not change

7. A tightly closed metal lid of a glass bottle can be opened more easily if it is put in ………… for some time.
   a. cold water   c. cold vinegar
   b. iced water   d. hot water

__Put (√) or (x):__

1- When the temperature of solids increases, their volume decrease. (X)
2- Substances change from liquid state into gas state during evaporation process. (√)
3- Spaces between molecules of a substance increase by decreasing the temperature of this substance. (X)
4- Expansion and contraction of matter occur due to changes in temperature. (√)
5- Expansion and contraction are two opposite processes. (√)

6- When a liquid is cooled, it may change into gas. (**X**)

Write the scientific term of each of the following:

- The state of matter which changes into liquid state by heating. (**solid**)
- The state of matter which changes into liquid state by cooling. (**gas**)
- It is the increase of the size of a substance due to increasing of its temperature. (**expansion**)
- It is the decrease of the size of a substance due to decreasing of its temperature. (**contraction**)

Complete the following sentences using the words below:

(expand – contract - faster – slower - increase - decrease - near to - away from - thermometer)

1) Cooling causes matter to **contract**, and causes particles to move **slower**.
2) When a liquid is freezes, the spaces between its molecules **decrease** causing their movement **near to** each other.
3) Heating causes matter to **expand**, and causes particles to move **faster**.
4) When a liquid is heated, the spaces between its molecules **increase** causing their movement **away from** each other.
5) Expansion and contraction of liquids explain how a **thermometer** works.

Give reasons for:

- Matter expands when its thermal energy increases.
    - **Because when the thermal energy of a matter increases, the kinetic energy of its molecules increases and the spaces between its molecules increase causing its expansion.**

- The size of a balloon decreases if it is subjected to a cold weather.
    - **Because the air inside the balloon contracts by cooling.**

<u>What happens to...:</u>

- The size of an inflated balloon if it is put in hot weather.
    - **Its size will increase.**
- The volume of matter when it is cooled.
    - **Its volume will decrease.**

<u>Look at the figures below that show a metallic ball that can pass through the ring easily. When the ball is heated, the ball cannot pass through the same ring.</u>



<u>Complete the following sentences using the words below:</u>

(**heat – cool - expansion – contraction – kinetic**)

1. When we **<u>heat</u>** the ball, the **<u>kinetic</u>** energy of its molecules increases.
2. After heating the ball, the ball cannot pass as a result of its **<u>expansion</u>**.
3. If we **<u>cool</u>** the ball, it can pass through the ring again as a result of its **<u>contraction</u>**.

Lesson 6

Choose the correct answer:

1. Metallic parts of a bridge .... in different temperatures.
   a. expand only
   b. contract only
   c. expand and contract
   d. never expand or contract

2. When the kinetic energy of liquids decreases, they may ....
   a. expand
   b. contract
   c. evaporate
   d. disappear

3. Railroad tracks are made up of ....
   a. glass
   b. coal
   c. plastic
   d. iron

4. Engineers leave .... between railroad tracks.
   a. small spaces
   b. very large spaces
   c. large spaces
   d. no spaces

5. Materials .... by .... their temperatures.
   a. expand – decreasing
   b. contract – increasing
   c. contract - decreasing
   d. melt - decreasing

Put (√) or (x):

1- Engineers use expansion joints to keep bridges safe. (√)
2- Temperature increases in hot weather causing contraction of materials. (X)
3- Railroad tracks are made up of iron. (√)
4- No spaces are left between railroad tracks. (X)
5- Without leaving spaces between railroad tracks, train accidents may occur. (√)
6- Volume of metals increases during expansion and decreases during contraction. (√)

Write the scientific term of each of the following:

- Joints allow expansion and contraction of some parts of bridges during temperature changes.
  (**expansion joints**)
- Decreasing the volume of a substance as a result of decreasing its temperature. (**contraction**)
- It is the state of matter that has a fixed shape and spaces between its molecules are very narrow. (**solid**)
- It is the state that doesn't have fixed shape or volume.
  (**gas**)

Complete the following sentences using the words below:

(Increases – decreases – expand – contract – heating – cooling)

1) When the temperature **increases** in hot weather, metallic parts of a bridge **expand**.
2) When the temperature **decreases** in cold weather, metallic parts of a bridge **contract**.
3) Metals expand by **heating** and contract by **cooling**.

Give reasons for:

- Expansion joints are designed in bridges.
  - **To keep bridges safe from buckling when they expand at high temperatures.**

- Small spaces are left between the railroad tracks.
  - **To allow these tracks to expand in hot weather without being bent to avoid train accidents.**

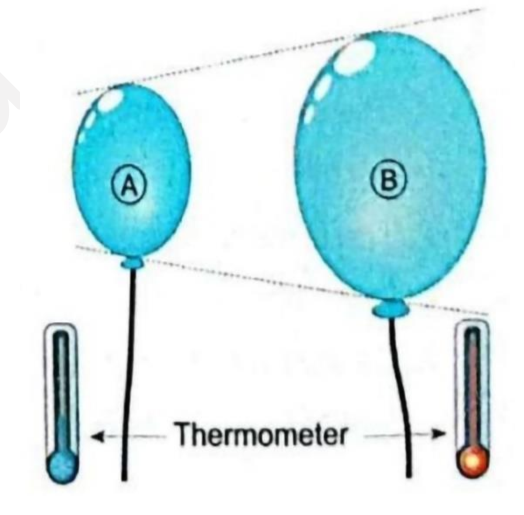
What happens to ....:

- Bridges if expansion joints are not designed.
  - **Buckling of bridges occurs as a result of expanding at high temperatures.**

- The railroad tracks if no spaces are left between them.
  - **Train accidents occurs as a result of bending of tracks in hot weather.**

Look at the picture below that shows 2 similar inflated balloons A and B, If one of them is placed in a low temperature place and the other is placed in a higher temperature place.

Put (√) or (x):



1. Molecules of air move in balloon (A) faster than in balloon (B). (**X**)

2. Spaces between molecules of air in balloon (B) are greater than that of air in balloon (A). (**√**)

3. Air expands in balloon (A) and contracts in balloon (B). (**X**)

Unit 2 – concept 2
{ Heat transfer }

Lesson 1

- The pictures show different bodies interact with hotter objects (objects with higher temperature) such as:
  - **In picture (1)**, when your hand touches the hot cup of tea, you feel the hotness of the cup.



  - **In picture (2)**, when the boy touches the hot slide in the sunny day, he feels the hotness of the slide.



From the previous, we can conclude that ***when objects with different temperatures come in contact with each other, heat transfer takes place.***

What happens to an object when heat is transferred?

- Heat transfers from the ***hotter object*** (object with higher temperature) to the ***cooler object*** (object with lower temperature) that causes the molecules in object with lower temperature will start to **move faster** while the molecules of the object with higher temperature will **move slower**.

Example:

- In the opposite picture:



1) The rock absorbs thermal energy from the sun rays, so the molecules of the rock move faster.

2) When the lizard stands on the rock, the skin of lizard absorbs thermal energy that is released from the rock. So, the molecules of the rock will move slower while the molecules in the skin of lizard will move faster.

- الصور توضح تفاعل الأجسام المختلفة مع الأجسام الأكثر سخونة (الأجسام ذات درجة الحرارة الأعلى) مثل:
  - **في الصورة (1)**، عندما تلمس يدك كوب الشاي الساخن، تشعر بسخونة الكوب.
  - **في الصورة (2)**، عندما يلمس الصبي الشريحة الساخنة في يوم مشمس، يشعر بسخونة الشريحة.

مما سبق، يمكننا أن نستنتج أنه **عندما تتلامس الأجسام ذات درجات الحرارة المختلفة مع بعضها البعض، يحدث انتقال الحرارة.**

ماذا يحدث لجسم عندما تنتقل الحرارة؟

- تنتقل الحرارة من الجسم **الأكثر سخونة** (الجسم ذو درجة الحرارة الأعلى) إلى الجسم **الأكثر برودة** (الجسم ذو درجة الحرارة المنخفضة) مما يجعل الجزيئات الموجودة في **الجسم ذو درجة الحرارة المنخفضة** ستبدأ في التحرك بشكل **أسرع** بينما تتحرك جزيئات **الجسم ذو درجة الحرارة المرتفعة** بشكل **أبطأ**.

مثال:

في الصورة المقابلة:

- يمتص الصخر الطاقة الحرارية من أشعة الشمس، فتتحرك جزيئات الصخر بشكل أسرع.
- عندما تقف السحلية على الصخرة، جلد السحلية يمتص الطاقة الحرارية المنطلقة من الصخور. لذلك، فإن جزيئات الصخر سوف تتحرك بشكل أبطأ في حين سوف تتحرك الجزيئات الموجودة في جلد السحلية بشكل أسرع.

- Thermal energy transfers when two materials with different temperatures touch each other. The thermal energy transfers from the object with higher temperature to the object with lower temperature.

There are two types of materials according to their ability to transfer thermal energy which are:



Thermal conductors

(**Good conductors of heat**)

They are materials that allow thermal energy to transfer through.

Example: Metals such as iron.

Thermal insulators

(**Bad conductors of heat**)

They are materials that resist the transfer of thermal energy.

Example: Plastic.

- الطاقة الحرارية تنتقل عندما تتلامس مادتان لهما درجات حرارة مختلفة.
تنتقل الطاقة الحرارية من الجسم ذو درجة الحرارة الأعلى إلى الجسم ذو درجة الحرارة المنخفضة.

هناك نوعان من المواد حسب قدرتها على نقل الطاقة الحرارية وهما:

1) الموصلات الحرارية

(موصلة جيدة للحرارة) وهي المواد التي تسمح بانتقال الطاقة الحرارية من خلالها.

مثال: المعادن مثل الحديد.

2) العوازل الحرارية

(سيئة التوصيل للحرارة) وهي مواد تقاوم انتقال الطاقة الحرارية.

مثال: البلاستيك.

An example that shows the meaning of thermal conductors and thermal insulators:

Iron

Iron is a thermal conductor that transfers the heat of the electric iron to the cloth in order to ironing it.



Electric iron

Plastic

Plastic is a thermal insulator that does not allow heat to transfer through, so you can hold it without feeling the hotness of the electric iron.

مثال يوضح معنى الموصلات الحرارية والعوازل الحرارية:

المكواة الكهربائية

حديد

- الحديد هو موصل حراري ينقل حرارة المكواة الكهربائية إلى القماش من أجل كيه.

بلاستيك

- البلاستيك عبارة عن عازل حراري لا يسمح بمرور الحرارة من خلاله، لذلك يمكنك الاحتفاظ به دون الشعور بسخونة المكواة الكهربائية.

What Do you Already Know About Heat Transfer?

- Heat is the transfer of thermal energy caused by a difference in temperature between molecules.

In this activity, we will study some properties of heat.

heat cannot be lost but it's only transferred

Some properties of heat

heat is an essential component of life on Earth.

heat flows from a hotter object to a cooler object.

- Thermal energy relates to the total sum of the kinetic energy of molecules and atoms of a substance, so any substance has thermal energy even the cold substances as they have molecules that always move.

ماذا تعرف بالفعل عن انتقال الحرارة؟

- الحرارة هي انتقال الطاقة الحرارية الناتج عن اختلاف درجة الحرارة بين الجزيئات.

سندرس في هذا النشاط بعض خواص الحرارة.

بعض خواص الحرارة:

- **تتدفق الحرارة من كائن أكثر سخونة لكائن أكثر برودة.**
- **الحرارة عنصر أساسي للحياة على الأرض.**
- **لا يمكن فقدان الحرارة ولكن يتم نقلها فقط.**

- الطاقة الحرارية تتعلق بمجموع الطاقة الحركية لجزيئات وذرات المادة، لذلك فإن أي مادة لها طاقة حرارية حتى المواد الباردة حيث أن لها جزيئات تتحرك دائما.



What is heat?

- All materials around us are composed of molecules and atoms that vibrate all the time.
- When a matter becomes warmer, the kinetic energy of its atoms or molecules increases, and when that happens, the molecules vibrate faster.

How does matter become warmer?

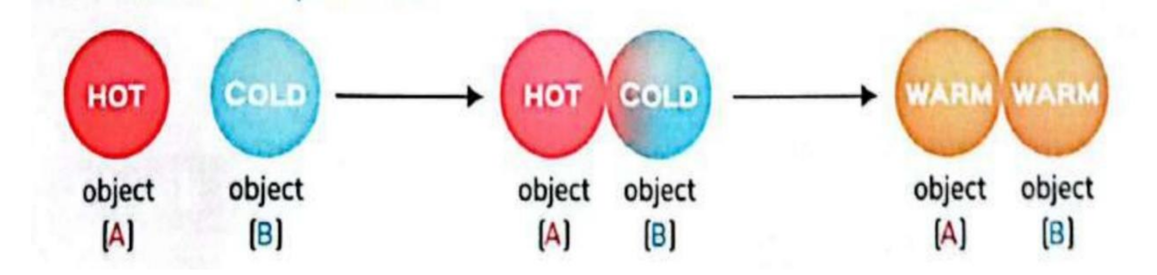
- Matter gets warmer by transferring of thermal energy from hotter matter to cooler one that is known as heat.

Example:

- When a hot food is left on a table for some time, it gets cold because the heat flows from the hot food to the cooler air around it.



- So, heat is transferred when there is a temperature difference between two objects, and it flows from the hotter object to the cooler one until both objects reach the same temperature that is known as ***thermal equilibrium***.



The heat transfers from higher temperature object (A) to lower temperature object (B), until they are equal in temperature

- The measuring unit of heat is called ***calorie***.
- If you hit a piece of metal several times by a hammer, the piece of metal becomes warm.

- جميع المواد من حولنا تتكون من جزيئات وذرات تهتز طوال الوقت.
- عندما تصبح المادة أكثر سخونة، تزداد الطاقة الحركية لذراتها أو جزيئاتها، وعندما يحدث ذلك، تهتز الجزيئات بشكل أسرع.

كيف تصبح المادة أكثر دفئا؟

- تصبح المادة أكثر دفئًا عن طريق نقل الطاقة الحرارية من مادة أكثر سخونة إلى مادة أكثر برودة تُعرف بالحرارة.

مثال :

- عندما يُترك طعام ساخن على الطاولة لبعض الوقت، فإنه يصبح باردًا لأن الحرارة تتدفق من الطعام الساخن إلى الهواء البارد المحيط به.
- لذلك تنتقل الحرارة عند وجود اختلاف في درجة الحرارة بين جسمين وتتدفق من الجسم الأكثر سخونة إلى الجسم الأكثر برودة حتى يصل الجسمان إلى نفس درجة الحرارة وهو ما يعرف بالتوازن الحراري.

تنتقل الحرارة من الجسم الأعلى درجة حرارة (أ) إلى الجسم الأقل حرارة (ب)، حتى يصبحا متساويين في درجة الحرارة

- وحدة قياس الحرارة تسمى **السعرات الحرارية**.
- إذا ضربت قطعة معدنية عدة مرات بالمطرقة فإن القطعة المعدنية تصبح دافئة.

Final Temperature

- Thermal energy flows from an object with higher temperature to another object with lower temperature until thermal equilibrium takes place or the two objects reach the same temperature.

In this lesson, we will make an experiment that shows how thermal energy flows and how thermal equilibrium takes place.

درجة الحرارة النهائية

- الطاقة الحرارية تتدفق من جسم ذي درجة حرارة أعلى إلى جسم آخر بدرجة حرارة أقل حتى يحدث التوازن الحراري أو وصول الجسمين إلى نفس درجة الحرارة.

سنقوم في هذا الدرس بإجراء تجربة توضح كيفية تدفق الطاقة الحرارية وكيفية حدوث التوازن الحراري.

Tools:

Empty beaker - Beaker contains 100 ml. of hot water with temperature (60°C) - Beaker contains 100 ml. of cold water with temperature (10°C) – Thermometer - Spoon.

الأدوات:

كوب فارغ - كوب يحتوي على 100 مل. من الماء الساخن بدرجة حرارة (60 درجة مئوية) - كوب يحتوي على 100 مل. من الماء البارد بدرجة حرارة (10 درجات مئوية) – ميزان حرارة – ملعقة.

Steps:

1. Record the temperature of water in beaker (1) (60°C) and the temperature of water in beaker (2) (10°C) in the table below.
2. Calculate the average temperature of water in the two beakers using the following rule:

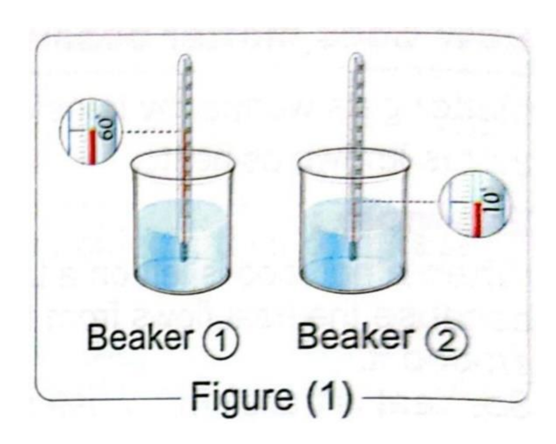


Figure (1)

$$\text{Average temperature of water} = \frac{\text{Temperature of water in beaker (1)} + \text{Temperature of water in beaker (2)}}{2}$$

Then, record the average temperature of water in the table below.

الخطوات:

1) سجل درجة حرارة الماء في الدورق (60 درجة مئوية) ودرجة حرارة الماء في الدورق 2 (10 درجات مئوية) في الجدول أدناه.
2) احسب متوسط درجة حرارة الماء في الكأسين باستخدام القاعدة التالية:

$$\text{متوسط درجة حرارة الماء} = \frac{\text{درجة حرارة الماء في الوعاء (1)} + \text{درجة حرارة الماء في الوعاء (2)}}{2}$$

ثم سجل متوسط درجة حرارة الماء في الجدول أدناه.

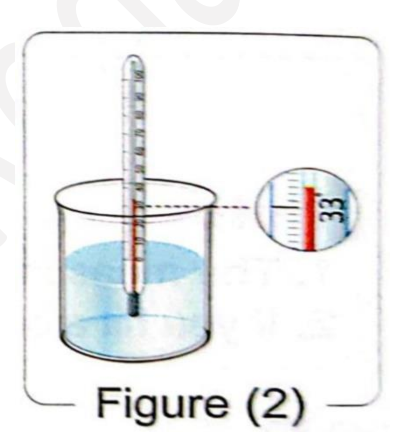


Figure (2)

3. Pour the two amounts of water in the empty beaker, then use the spoon to mix them together.

4. Wait for 3 minutes and measure the final temperature of the third beaker and record it in the table below.

5. Compare the final temperature of water to the average temperature of water that you have calculated before.

3) اسكبي مقداري الماء في الدورق الفارغ، ثم استخدمي الملعقة لخلطهما معًا.
4) انتظر لمدة 3 دقائق وقم بقياس درجة الحرارة النهائية للكوب الثالث وسجلها في الجدول أدناه.
5) قارن درجة الحرارة النهائية للماء بمتوسط درجة حرارة الماء التي قمت بحسابها من قبل.

Temperature of hot water	60°C
Temperature of cold water	10°C
Average temperature of water	$\frac{60 + 10}{2} = 35°C$
Final temperature of water after mixing	33°C

Observation:
The final temperature of water (33°C) almost equals the average temperature of water (35°C) that you have calculated before.

درجة الحرارة النهائية للماء (33 درجة مئوية) تعادل تقريبًا متوسط درجة حرارة الماء (35 درجة مئوية) التي حسبتها من قبل.

Conclusion:

- When two substances with different temperatures come in contact with each other, thermal energy transfers from the hotter object to the cooler object until thermal equilibrium happens and they reach the same temperature.

  عندما تتلامس مادتان لهما درجات حرارة مختلفة، تنتقل الطاقة الحرارية من الجسم الأكثر سخونة إلى الجسم الأكثر برودة حتى يحدث التوازن الحراري وتصلان إلى نفس درجة الحرارة.

- When mixing two substances with different temperatures, their final temperature at thermal equilibrium almost equals their average temperature, so the final temperature of them is between the temperature of the hotter substance and the temperature of the cooler substance.

- In some cases, the final temperature when mixing two substances with different temperatures is less than their average temperature as there is some thermal energy transfers to the air or the container.

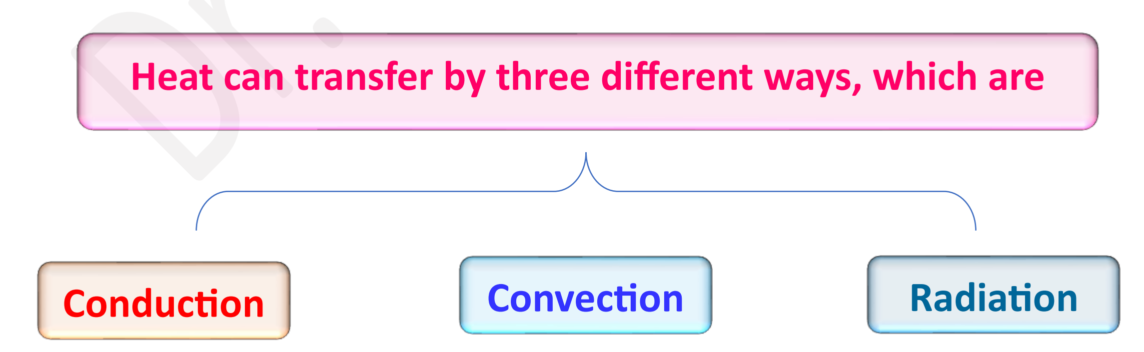
- ❖ After mixing two substances with different temperatures, the motion of their molecule’s changes, where:
    - The molecules of the hotter substance become slower after mixing.
    - The molecules of the cooler substance become faster after mixing.

- عند خلط مادتين لهما درجات حرارة مختلفة فإن درجة حرارتهما النهائية عند التوازن الحراري تكاد تساوي متوسط درجة حرارتهما، فتكون درجة الحرارة النهائية لهما بين درجة حرارة المادة الأكثر سخونة ودرجة حرارة المادة الباردة.
- في بعض الحالات تكون درجة الحرارة النهائية عند خلط مادتين بدرجات حرارة مختلفة أقل من متوسط درجة حرارتهما لوجود بعض الطاقة الحرارية التي تنتقل إلى الهواء أو الوعاء.
- بعد خلط مادتين لهما درجات حرارة مختلفة تتغير حركة جزيئاتهما حيث :
    - جزيئات المادة الأكثر سخونة تصبح أبطأ بعد الخلط.
    - جزيئات المادة المبردة تصبح أسرع بعد الخلط.



Conduction, convection and radiation

How thermal energy transfers from one place to another?



Conduction:

- Heat transfers by conduction when objects with different temperatures touch each other.

Example:

- When you have a fever and your temperature is high, you put cooling pads to transfer the heat from your body to the cooling pads by direct contact.



Cooling pads

- ***Heat transfers by conduction in solids only.***

كيف تنتقل الطاقة الحرارية من مكان إلى آخر؟

يمكن أن تنتقل الحرارة بثلاث طرق مختلفة، وهي:

- التوصيل - الحمل الحراري - الإشعاع

التوصيل:

- تنتقل الحرارة بالتوصيل عندما تتلامس أجسام ذات درجات حرارة مختلفة مع بعضها البعض.

مثال:

- عندما تصاب بالحمى وتكون درجة حرارتك مرتفعة، تقوم بوضع وسادات تبريد لنقل الحرارة من جسمك إلى وسادات التبريد عن طريق الاتصال المباشر.

- **تنتقل الحرارة بالتوصيل في المواد الصلبة فقط.**

Convection:

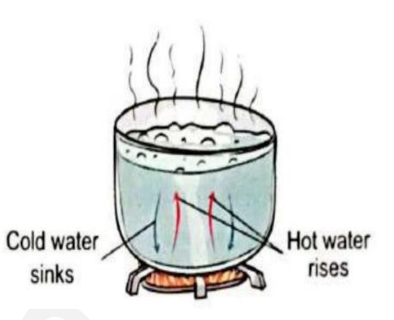
- Heat transfers by convection due to the movement of a liquid or gas.

Example:

- When we cook noodles, we put noodles and water in a pot.
- During heating, the noodles close to the bottom of the pot that near the heat source get hot and rise to the surface, then cold noodles at the surface moves down to the bottom of the pot and so on.



- The movement of noodles up and down shows the movement of water in the pot during heating, where:
  - Hot water at the bottom of the pot moves up.
  - Cold water at the surface of the pot moves down.
  - The continuous movement of water up and down causes the transfer of heat through water by a way known as ***convection***.



Radiation:

- Heat transfers by radiation through gases and space.

Example :

- When your hand gets close to a fire, you feel warm because the air between the fire and your hand allows the thermal energy of the fire to transfer to your hand.



- In sunny days, we feel the heat of the Sun although there is a space between the Sun and Earth. Space where the thermal energy of the sun transfers to Earth through the space by a way known as ***radiation***.



الحمل الحراري:

- تنتقل الحرارة بالحمل نتيجة حركة سائل أو غاز.

مثال:

- عندما نقوم بطهي المعكرونة، نضع المعكرونة والماء في وعاء.

- أثناء التسخين، تسخن المعكرونة القريبة من قاع الإناء القريب من مصدر الحرارة وترتفع إلى السطح، ثم تتحرك المعكرونة الباردة على السطح إلى أسفل إلى قاع الإناء وهكذا.
  - حركة المعكرونة إلى الأعلى والأسفل تدل على حركة الماء في الوعاء أثناء التسخين، حيث:
    - الماء الساخن الموجود في قاع الإناء يتحرك للأعلى.
    - يتحرك الماء البارد الموجود على سطح الإناء إلى الأسفل.
    - إن الحركة المستمرة للماء لأعلى ولأسفل تؤدي إلى انتقال الحرارة عبر الماء بطريقة تعرف **بالحمل الحراري**.

الإشعاع:

- تنتقل الحرارة بالإشعاع عبر الغازات والفضاء.

مثال :

- عندما تقترب يدك من النار، تشعر بالدفء لأن الهواء الموجود بين النار ويدك يسمح للطاقة الحرارية للنار بالانتقال إلى يدك.
- في الأيام المشمسة نشعر بحرارة الشمس بالرغم من وجود مسافة بين الشمس والأرض. الفضاء حيث تنتقل الطاقة الحرارية من الشمس إلى الأرض عبر الفضاء بطريقة تعرف **بالإشعاع**.

The speed of transfer of heat

The speed of heat transfer between objects increases when ...

تزداد سرعة انتقال الحرارة بين الأجسام عندما...

The difference in temperature between objects increases
يزداد الفرق في درجات الحرارة بين الأجسام

Surface area of objects increases
تزداد مساحة سطح الأشياء

Time of contact between objects increases
يزداد وقت الاتصال بين الأشياء

- Meteorologists (scientists who study weather) must understand convection and radiation to help them predict the weather.
- Engineers must understand conduction, convection and radiation to design new products such as tools of cooking and also design sidewalks that are cooler and shadier.

- يجب على علماء الأرصاد الجوية (العلماء الذين يدرسون الطقس) فهم الحمل الحراري والإشعاع لمساعدتهم على التنبؤ بالطقس.
- يجب أن يفهم المهندسون التوصيل والحمل الحراري والإشعاع لتصميم منتجات جديدة مثل أدوات الطبخ وأيضًا تصميم أرصفة أكثر برودة وأكثر ظلًا.

Thermal Insulation and Conductivity

- Materials are classified according to the rate of transferring heat into:

Thermal conductors

They are materials that allow thermal energy to transfer through .

Or

They are materials that allow heat to travel freely through them.

Examples:

Metals such as copper, iron and aluminum.

Thermal insulators

They are materials that resist the transfer of thermal energy.

Or

They are materials that slow down the heat transfer.

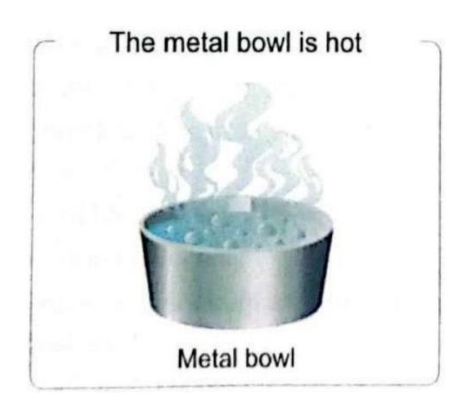
Examples:

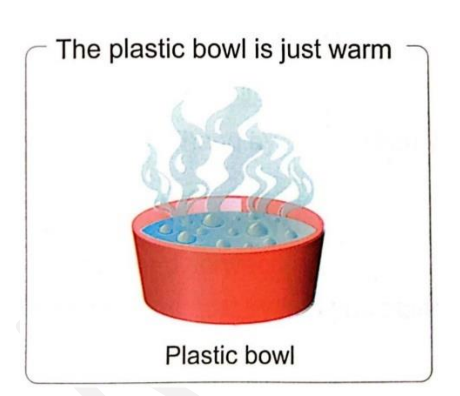
Air, plastic, wood and glass.

- Thermal insulators cannot prevent the transfer of heat completely, but they slow down the heat transfer through them.

Examples:

1) If you pour hot water into a metal bowl and a plastic bowl, you will notice that:





Because:

- Metal is a thermal conductor, so it allows thermal energy to transfers through.
- Plastic is a thermal insulator, so it slows down the transfer of thermal energy.

العزل الحراري والموصلية

- تصنف المواد حسب معدل انتقال الحرارة إليها إلى:

الموصلات الحرارية

هي مواد تسمح بانتقال الطاقة الحرارية من خلالها.

أو

إنها مواد تسمح للحرارة بالانتقال بحرية من خلالها.

أمثلة:

المعادن مثل النحاس والحديد والألومنيوم.

العوازل الحرارية

وهي مواد تقاوم نقل الطاقة الحرارية.

أو

إنها مواد تعمل على إبطاء انتقال الحرارة.

أمثلة:

الهواء والبلاستيك والخشب والزجاج.

- لا تستطيع العوازل الحرارية منع انتقال الحرارة بشكل كامل، لكنها تبطئ انتقال الحرارة من خلالها.

أمثلة:

1. إذا قمت بصب الماء الساخن في وعاء معدني ووعاء بلاستيكي، ستلاحظ أن:
   - الوعاء المعدني ساخن
   - الوعاء البلاستيكي دافئ فقط

لأن:

- المعدن موصل للحرارة، لذلك يسمح بانتقال الطاقة الحرارية من خلاله.
- البلاستيك مادة عازلة للحرارة، لذا فهو يبطئ عملية نقل الطاقة الحرارية.

2) If you touch a metal doorknob, you may feel that it is cooler than the wooden door it is on. Because your body always generates thermal energy, where :

- Thermal energy transfers fast from your hand to the metal doorknob which is a thermal conductor.
- Thermal energy transfers slowly from your hand to the wooden door which is a thermal insulator.



2. إذا لمست مقبض باب معدني، فقد تشعر أنه أكثر برودة من الباب الخشبي الموجود عليه. لأن جسمك يولد دائمًا طاقة حرارية، حيث :
   - تنتقل الطاقة الحرارية بسرعة من يدك إلى مقبض الباب المعدني وهو موصل للحرارة.
   - تنتقل الطاقة الحرارية ببطء من يدك إلى الباب الخشبي الذي يعتبر عازلاً للحرارة.



Heat transfer in different materials

- When we want to make a pot to cook food in it, we should use a thermal conductor material such as metal. But when we want to make handles for that pot, we should use a thermal insulator material such as wood or plastic. So, it is safe to touch the handle during cooking.

- If we place three temperature measuring devices along the handle of a pot during heating, we will see three different temperatures. So, the length of the handle is very important.

- عندما نرغب في صنع وعاء لطهي الطعام فيه، يجب أن نستخدم مادة موصلة للحرارة مثل المعدن. ولكن عندما نريد أن نصنع مقابض لذلك الوعاء يجب أن نستخدم مادة عازلة للحرارة مثل الخشب أو البلاستيك. لذلك، من الآمن لمس المقبض أثناء الطهي.
- إذا وضعنا ثلاثة أجهزة لقياس درجة الحرارة على طول مقبض القدر أثناء التسخين، فسنرى ثلاث درجات حرارة مختلفة. لذا فإن طول المقبض مهم جدًا.

Examples:

- If you place a pan with 18 cm handle made of plastic on a stove, and then you measure the temperature at three places on the handle. The result can be as follows:

أمثلة:

إذا وضعت مقلاة بقطر 18 سم ضع المقبض المصنوع من البلاستيك على الموقد، ثم قم بقياس درجة الحرارة في ثلاثة أماكن على المقبض. يمكن أن تكون النتيجة على النحو التالي:

Matter of handle	Length of handle (cm)	Time heated (min)	Temperature near pan (°C)	Temperature middle of handle (°C)	Temperature end of handle (°C)
Plastic	18	10	54	24	23

- If you use a pan with a 36 cm handle made of plastic, the measurements can be as follows:

إذا كنت تستخدم مقلاة مقاس 36 سم مقبض مصنوع من البلاستيك، ويمكن أن تكون القياسات على النحو التالي:

Matter of handle	Length of handle (cm)	Time heated (min)	Temperature near pan (°C)	Temperature middle of handle (°C)	Temperature end of handle (°C)
Plastic	36	10	54	23	22

- When you change the matter of the handle using a wooden handle with 36 cm length, the measurements can be as follows:

عند تغيير أمر المقبض باستخدام مقبض خشبي بقياس 36 سم الطول، يمكن أن تكون القياسات على النحو التالي:

Matter of handle	Length of handle (cm)	Time heated (min)	Temperature near pan (°C)	Temperature middle of handle (°C)	Temperature end of handle (°C)
Wood	36	10	60	25	24

From the previous examples, we can conclude that:

- The measurements of temperature differ from one place to another along the handle of the pan.
- The handle is warmer closer to the pan and it is cooler as we go far away from the pan, because the heat travels very slowly along the handle that is made of a thermal insulting material.
- The wooden handle warms up faster than the plastic handle.

من الأمثلة السابقة يمكننا أن نستنتج ما يلي:

- تختلف قياسات درجة الحرارة من مكان إلى آخر على طول مقبض المقلاة.
- المقبض يكون أكثر دفئا بالقرب من المقلاة ويكون أكثر برودة كلما ابتعدنا عن المقلاة، لأن الحرارة تنتقل ببطء شديد على طول المقبض المصنوع من مادة عازلة للحرارة.
- يسخن المقبض الخشبي بشكل أسرع من المقبض البلاستيكي.

Heat and Conservation of Mass

- When any matter changes from one state into another by gaining or losing of thermal energy, its mass does not change, and this is called the ***law of conservation of mass***.

Law of conservation of mass

The mass of a substance does not change when this substance changes from one state into another.

So, ***no matter is destroyed or created but it just changes from one state into another.***

Examples:

1) When you put a bowl of ice cubes on the stove, the ice cubes changes into liquid water.



The mass of the ice cubes before heating equals the mass of water after heating.



2) If you put a plastic cup of a juice in a freezer, it freezes but its mass does not change before and after freezing.

الحرارة وحفظ الكتلة

- عندما تتغير أي مادة من حالة إلى أخرى باكتساب أو فقدان طاقة حرارية فإن كتلتها لا تتغير وهذا ما يسمى قانون حفظ الكتلة.

قانون حفظ الكتلة :

- لا تتغير كتلة المادة عندما تتغير هذه المادة من حالة إلى أخرى.

إذن، **لا يتم تدمير المادة أو خلقها، ولكنها تتغير من حالة إلى أخرى**.

أمثلة:

1) عند وضع وعاء من مكعبات الثلج على الموقد، تتحول مكعبات الثلج إلى ماء سائل.
كتلة مكعبات الثلج قبل التسخين تساوي كتلة الماء بعد التسخين.

2) إذا وضعت كوباً بلاستيكياً من العصير في الثلاجة، فإنه يتجمد ولكن كتلته لا تتغير قبل وبعد التجمد.

- There are some cases that the mass of a substance before the change does not equal the mass of the same substance after the change. That is because the substance is mixed with other substance.

Example:

- If you have 100 grams of popcorn grains and they have a small amount of moisture (water) in them. When they are cooked, they become 97 grams only. The loss in mass is due to the evaporation (vaporization) of the water during cooking.

- هناك بعض الحالات التي لا تكون فيها كتلة المادة قبل التغير تساوي كتلة نفس المادة بعد التغير. وذلك لأن المادة مخلوطة بمادة أخرى.

مثال :

- إذا كان لديك 100 جرام من حبوب الفشار وتحتوي على كمية صغيرة من الرطوبة (الماء). وعندما تنضج يصبح وزنها 97 جرامًا فقط. يرجع فقدان الكتلة إلى تبخر (تبخر) الماء أثناء الطهي.

- If any liquid substance changes into gas state, its mass does not change after evaporation even we don't see its gas state but it has a mass that equals its mass before change.

إذا تحولت أي مادة سائلة إلى الحالة الغازية فإن كتلتها لا تتغير بعد التبخر حتى أننا لا نرى حالتها الغازية ولكن لها كتلة تساوي كتلتها قبل التغير.



Design a marble run

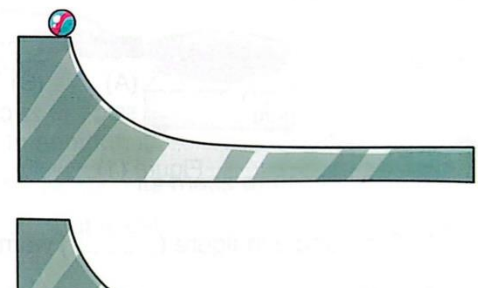
- Energy can change from one form to another.
- In some cases, when energy changes from one form to another, there are some loss.

Example:

- When a bicycle go down a slide, its potential energy changes to kinetic energy
- The bicycle stops after some time because there is a friction between tires of the bicycle and the road.

So, some of the kinetic energy changes to thermal energy due to the friction.

<u>Imagine that you have designed a marble track as in the opposite picture, where:</u>



- ❖ If you put the marble at the top of the track, then leave it to move down the track.
- ❖ You will observe that the marble will not reach the end of the track.

From the previous, you would notice that:

- At the top of the track, the marble has the most potential energy.
- As the marble moves down the track the potential energy changes to kinetic energy.
- As the marble moves along the track, some kinetic energy changes to thermal energy due to the friction between the marble and the track, that decreases the speed of the marble, so it doesn't reach the end of the track.
- If you use a larger marble, it will move downward faster because it has a larger mass so it gains more kinetic energy.

تصميم مسار كرة البلي:

- الطاقة يمكن أن تتغير من شكل إلى آخر.
- في بعض الحالات، عندما تتغير الطاقة من شكل إلى آخر، يكون هناك بعض الفقد.

<u>مثال:</u>

- عندما تنزل الدراجة على منحدر، تتغير طاقتها الكامنة إلى طاقة حركية
- تتوقف الدراجة بعد مرور بعض الوقت بسبب حدوث احتكاك بين إطاراتها الدراجة والطريق.
- إذن فإن بعض الطاقة الحركية تتحول إلى طاقة حرارية بسبب الاحتكاك.

تخيل أنك قمت بتصميم مسار كرة البلي كما في الصورة المقابلة، حيث:

- إذا وضعت كرة البلي في أعلى المسار، فاتركها لتتحرك أسفل المسار.
- ستلاحظ أن كرة البلي لن تصل إلى نهاية المسار.

مما سبق تلاحظ أن:

- في أعلى المسار، تتمتع كرة البلي بأكبر قدر من الطاقة الكامنة.
- عندما تتحرك الكرة على المسار تتغير طاقة الوضع إلى طاقة حركية.
- أثناء تحرك كرة البلي على طول المسار، تتغير بعض الطاقة الحركية إلى طاقة حرارية بسبب الاحتكاك بين كرة البلي والمسار، مما يقلل من سرعة الكرة، فلا تصل إلى نهاية المسار.
- إذا استخدمت كرة بلي أكبر حجمًا، فإنها ستتحرك للأسفل بشكل أسرع نظرًا لأن كتلتها أكبر وبالتالي تكتسب المزيد من الطاقة الحركية.



Properties of new materials

- People need different materials in different purposes.
- Every material is useful for some purposes not for all purposes, so scientists and engineers try to choose the most useful and suitable materials with some useful properties such as flexibility and conducting heat to make the products that people want.

Examples:

1) When making cloth, scientists use soft materials.
2) When making a bicycle or a car, engineers cannot use cloth.

- Scientists and engineers always work to create or improve new materials for different and new purposes.

- Sometimes, when scientists develop new materials, they focus on some specific properties of a material that they want develop.

Example:

- Scientists develop a **smart material** which is a flexible fabric that **keeps the temperature of the body**.

- These smart materials are used in making smart clothes that can:
  - Control your body temperature.
  - Light up in the dark.
  - Keep themselves clean.

- When scientists develop new materials, they study the structure of molecules of materials to understand their chemical structures that helps in understanding their properties.

خصائص المواد الجديدة:

- يحتاج الناس إلى مواد مختلفة لأغراض مختلفة.
- كل مادة مفيدة لبعض الأغراض وليس لجميع الأغراض، لذلك يحاول العلماء والمهندسون اختيار المواد الأكثر فائدة وملاءمة مع بعض الخصائص المفيدة مثل المرونة وتوصيل الحرارة لصنع المنتجات التي يريدها الناس.

أمثلة:

1) عند صنع القماش، يستخدم العلماء مواد ناعمة.
2) عند صنع دراجة أو سيارة، لا يمكن للمهندسين استخدام القماش.

- يعمل العلماء والمهندسون دائمًا على إنشاء أو تحسين مواد جديدة لأغراض مختلفة وجديدة.
- في بعض الأحيان، عندما يقوم العلماء بتطوير مواد جديدة، فإنهم يركزون على بعض الخصائص المحددة للمادة التي يريدون تطويرها.

مثال:

- العلماء يطورون مادة ذكية وهي عبارة عن نسيج مرن يحافظ على درجة حرارة الجسم.
- تستخدم هذه المواد الذكية في صناعة الملابس الذكية التي يمكنها:
  - التحكم في درجة حرارة جسمك.
  - تضيء في الظلام.
  - المحافظة على نظافتهم.
- عندما يقوم العلماء بتطوير مواد جديدة، فإنهم يدرسون بنية جزيئات المواد لفهم تركيبها الكيميائي الذي يساعد في فهم خصائصها.

How are new materials created?

- Scientists make new materials by mixing different materials together.

كيف يتم إنشاء المواد الجديدة؟
يصنع العلماء مواد جديدة عن طريق خلط مواد مختلفة معًا.

Examples:

Steel

- It is made of a mixture of **iron** and other elements.
- It is **strong** and lasts for a long time.

الفُولَاذ (مادة الصلب)

- مصنوع من خليط من **الحديد** وعناصر أخرى.
- إنه **قوي** ويدوم لفترة طويلة.

Concrete

- It is made of a mixture of rock, sand and water.
- It is a liquid until it dries, it becomes hard.
- It is used as the base of buildings and bridges because it is very strong.

الخرسانة



- مكون من خليط من الصخور والرمل والماء.
- هو سائل حتى يجف فيصير قاسيا.
- يستخدم كقاعدة للمباني والجسور لأنها قوية جدا.

- In some cases, the new materials are created due to the ***chemical change***.
- When chemical change happens, the properties of the new materials differ from the properties of the original material.

Example:

- Plastic is made by chemical change of some of the compounds in petroleum.

- في بعض الحالات، يتم إنشاء المواد الجديدة نتيجة **للتغير الكيميائي**.
- عند حدوث تغير كيميائي فإن خواص المواد الجديدة تختلف عن خواص المادة الأصلية.

مثال:

- يتم تصنيع البلاستيك عن طريق التغير الكيميائي لبعض المركبات الموجودة في البترول.

Material	Petroleum (original material) البترول (المادة الأصلية)	Plastic (new material) البلاستيك (مادة جديدة)
Properties	- Liquid - Burns easily. - سائل. - يحترق بسهولة.	- Tough solid. - Often resists burning. - صلبة. - غالبا ما يقاوم الاحتراق.

- In some other cases, the new materials are created by mixing materials at high temperatures.

Examples:

1) Shrink-wrap is created when we add heat to plastic to make it shrink.


Shrink-wrap

2) Glass is made from a mixture of sand with small amount of other materials such as limestone and soda ash (sodium carbonate).
Glass is made when the sand mixture is heated in hot furnace so, it melts and changes into glass. Then the glass becomes hard when it cools.

- في بعض الحالات الأخرى يتم إنشاء المواد الجديدة عن طريق خلط المواد عند درجات حرارة عالية.

أمثلة:

1) يتم إنشاء غلاف الانكماش عندما نضيف الحرارة إلى البلاستيك لجعله ينكمش.
2) يصنع الزجاج من خليط الرمل مع كمية قليلة من مواد أخرى مثل الحجر الجيري ورماد الصودا (كربونات الصوديوم).
يتكون الزجاج من تسخين خليط الرمل في فرن ساخن، فيذوب ويتحول إلى زجاج. ثم يصبح الزجاج قاسيا عندما يبرد.

Unit 2 – Concept 2
{ Heat transfer }

interact	يتفاعل	touch	يلمس
sunny	مشمس	hotter	أسخن
transfer	ينتقل	hotness	سخونة
temperature	درجة الحرارة	cooler	أبرد
slide	زحلوقة	sun rays	أشعة الشمس
lizard	سحلية	absorb	يمتص
ironing	كي الملابس	ability	مقدرة
insulators	العوازل	conductors	الموصّلات
hurt	يتأذى	electric iron	المكواة الكهربائية
handle	مقبض	allow	يسمح
resistant	مقاوم	resist	يقاوم
difference	اختلاف	flow	سريان
properties	خصائص	lost	يفقد
essential	أساسي	relate	يرتبط
composed	تحتوي	get	يصبح
measuring unit	وحدة قياس	vibrate	يهتز
until	حتى	calorie	سعرة حرارية
left	يترك	thermal equilibrium	الاتزان الحراري
several	متعدد	hit	يضرب
hammer	مطرقة	reach	يصل
thermometer	ميزان الحرارة	rule	قاعدة

empty	فارغ	spoon	ملعقة
pour	يصب	beaker	دورق
average	متوسط	mix	يخلط
wait	ينتظر	final	نهائي
motion	حركة	almost	تقريبا
container	وعاء	adding	إضافة
fever	حمى	direct	مباشر
cooling pads	كمادات باردة	convection	الحمل
radiation	الإشعاع	conduction	التوصيل
continuous	مستمر	source	مصدر
space	فضاء / فراغ	noodles	معكرونة
rise	يرتفع لأعلى	sink	يغوص لأسفل
bottom	قاع	speed	سرعة
meteorologists	علماء الطقس	shadier	أكثر ظلالا
increase	يزداد	sidewalks	الأرصفة
surface area	مساحة السطح	classified	مصنّف
freely	بحرّية	copper	النحاس
prevent	يمنع	rate	معدّل
slow down	يبطئ	completely	تماما
aluminium	الألومنيوم	measuring devices	أجهزة القياس
length	طول	along	بطول
measurements	قياسات	stove	موقد

conservation	بقاء	gaining	اكتساب
destroyed	يفنى	losing	فقد
amount	كمية	loss	فقد
marble	كرة البلي	form	صورة
tires	إطارات	track	مسار
friction	احتكاك	slide	منحدر
downward	لأسفل	larger	أكبر
high	عالي	purposes	أغراض
suitable	مناسب	cloth	قماش
specific	معين / محدد	structure	تركيب
useful	مفيد	soft	ناعم
focus	يركّز	fabric	نسيج
improve	يطوّر	flexibility	مرونة
chemical	كيميائي	mixing	خلط
elements	عناصر	base	أساس
compounds	مركبات	furnace	فرن
steel	مادة الصلب	bridges	جسور
original	أصلي	tough	صلب
concrete	خرسانة	last	يبقى

Unit 2 – concept 2 - questions

Lesson 1

Choose the correct answer:

1. Any matter has thermal energy, because ....
    a. its molecule always move
    b. it has fixed shape
    c. its molecules don't move
    d. it has fixed volume

2. If heat transfers to a lower temperature object, its molecules will ....
    a. stop moving c. move faster
    b. move slower d. not be affected

3. Heat transfers from .... object to .... object.
    a. cooler – hotter c. bigger – smaller
    b. hotter – cooler d. smaller - bigger

4. The handle of an electric iron is made of ....
    a. iron
    b. thermal insulator material
    c. metal
    d. thermal conductor material.

5. All the following are properties of heat, except ....
    a. it is an essential component of life on Earth
    b. it cannot be lost but it is only transferred
    c. it flows from a cooler object to a hotter object
    d. it flows from a hotter object to a cooler object

6. If you stand on hot sand in bare feet, you will feel the hotness of the sand because ....
   a. heat transfers from your legs to sand
   b. heat transfers from sand to your legs
   c. your legs are hotter than sand
   d. your legs and sand have the same temperature

7. If you hold an ice cube in your hand, which of the following sentences is correct? ....
   a. Your hand temperature is lower than the ice temperature.
   b. The ice temperature is higher than your hand temperature.
   c. The ice and your hand have the same temperature.
   d. The molecules of ice will start to move faster.

Choose from column (B) what suits it in column (A):

(A)	(B)
1. plastic 2. metal 3. heat	a. is an essential component of life on Earth. b. is used to make the electric iron handle. c. is a thermal conductor. d. is the measuring unit of volume.

Put (√) or (x):

1- When objects with the same temperature touch each other, heat transfer takes place. ( )
2- Heat transfers from the cooler object to the hotter object.

( )

3- The molecules of the hotter object move slower than that of the cooler object. ( )

4- Thermal conductors are good conductors of heat. ( )

5- Plastic resists the transfer of thermal energy. ( )

6- In electric iron heat transfers from cloth to iron. ( )

7- Heat transfers between two objects that have the same temperature. ( )

8- Thermal energy relates to the total sum of the kinetic energy of substance's atoms and molecules. ( )

9- Molecules of cold or hot substances always move. ( )

Write the scientific term of each of the following:

- They are materials that allow thermal energy to transfer through. (………………………)
- They are materials that resist the transfer of thermal energy. (……………………………)
- Thermal insulator material used to make the handle of an electric iron. (……………………………)
- Thermal conductor material used to make lower part of an electric iron that is used in ironing clothes. (…………………………….)

Complete the following sentences:

1) When objects with different temperatures come in contact with each other …………………. transfer takes place.

2) Heat transfers from objects with …………………. temperature to objects with ……………………. temperature.
3) If you hold a cup of cold water, heat transfers from ……………………. to ……………………
4) Molecules of warmer matter move ……………………… than molecules of cooler matter.
5) When a cat stands on a car in a sunny day, its legs absorb …………………… energy that is released from the car.
6) There are two types of materials according to their ability to transfer thermal energy which are ……………………. and ……………………. materials.
7) The handle of an electric iron may be made of ………………… , while ……………………. is used to make lower part that is used in ironing clothes.
8) The handle of cooking pot must be made of thermal ……………………… materials.
9) Thermal energy relates to the total sum of the …………………. energy of substance's atoms and ……………………

Give reasons for:

- The handle of an electric iron is made of plastic.

 …………………………………………………………………………………………..

 …………………………………………………………………………………………..

- The lower part of an electric iron is made of iron.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

- You feel heat, when you touch a metal spoon placed in a hot cup of tea.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

<u>What happens to …:</u>

- ❖ The molecules' movement of a lizard's skin when it stands on a rock in a sunny day.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

<u>Look at the following figures that show two different objects, then complete the sentences below:</u>

HOT COLD → HOT COLD

Figure (1) Figure (2)

A. In figure (2), heat transfers from ………………… object to ……………………… object.

B. In figure (1) molecules of cold object move ……………………. than molecules of hot object.

Look at the figures below, then answer the questions:

- In which figure the hand will feel heat?

…………………………………………………………………………………………………

- Give a reason for your answer.

…………………………………………………………………………………………………

Iron handle

Figure (a)

Plastic handle

Figure (b)

Lesson 2

Choose the correct answer:

1. The average temperature is almost ………………. the final temperature of the mixture of two substances with different temperatures at the thermal equilibrium.
   a. more than b. less than c. equal to d. double

2. If you pour a cup of water with temperature 30°C to another cup of water with temperature 80°C, the final temperature of the mixture may be …………….
   a. 80°C b. 30°C c. 50°C d. 110°C

3. The final temperature of two mixed substances with different temperatures is less than that of the ……………. substance and greater than that of the ………………….. substance.
   a. hotter - cooler c. bigger - smaller
   b. cooler – hotter d. smaller – bigger

4. After mixing two substances with different temperatures, the molecules of the cooler substance ……………….
   a. will move faster c. will move slower
   b. will not be affected d. will stop moving

5. In the opposite figure, if some thermal energy of mixture transfers to the cup, the final temperature of this mixture will be …………… the average temperature.
   a. equal to c. more than
   b. double d. less than

Tea
70°C
Milk
30°C

6. ……………….. occurs when heat transfer stops between two objects as they read the same temperature.
   a. Calorie c. Sound equilibrium
   b. Heat flow d. Thermal equilibrium

7. The measuring unit of heat is called ………………….
   a. calorie b. kilogram c. gram d. meter

8. Hitting a piece of metal several times by a hammer causes ………………………
   a. the temperature of the metal becomes lower
   b. molecules of the metal move slower
   c. molecules of the metal move faster
   d. The metal becomes cooler

9. On heating a substance, the ……………. of its molecules ……………….
   a. kinetic energy – decreases c. kinetic energy - increases
   b. temperature – decreases d. movement – decreases

Put (√) or (x):

1- When mixing two substances with different temperatures, their average temperature is lower than their final temperature. (   )
2- After mixing two substances with different temperatures the molecules movement of the cooler substance becomes slower. (   )
3- The final temperature of two mixed substances with different temperatures is between the temperatures of hotter and cooler substances. (   )
4- The temperature of a hotter substance increases after it is mixed with a cooler substance. (   )
5- When you add some cool water to hot tea the molecules of tea will move slower. (   )
6- When kinetic energy of molecules decreases, they vibrate slower. (   )
7- Heat is measured in calorie. (   )
8- Thermal equilibrium means that the objects in contact reach the same temperature. (   )

Write the scientific term of each of the following:

- It occurs when heat transfer stops between two objects reach the same temperature. (…………………………….)
- It is the measuring unit of heat. (…………………………….)

Complete the following sentences using the words below:

(**thermal equilibrium – faster – equals – hotter – cooler**)

1) When you mix two substances with different temperatures, their final temperature at thermal equilibrium almost ……………………… their average temperature.
2) Molecules of cooler substance move …………………….. after mixing it with hotter substance.
3) The final temperature of two mixed substances with different temperatures is between the temperature of the ………………… substance and the temperature of the …………………….. substance.
4) When mixing two substances with different temperatures, they reach the same temperature at …………………

Give reasons for:

- Sometimes the final temperature of a mixture of two substances with different temperatures is less than their average temperature.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- Heat transfer stops after a while between two mixed substances with different temperatures.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

- After mixing two substances with different temperatures the molecules of the hotter substance move slower.

…………………………………………………………………………………………………

……………………………………………………………………………………………

- The vibration of molecules of a matter increases when it becomes warmer.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens to…:

- ❖ Molecules' movement of a hotter substance after mixing it with a cooler substance.

……………………………………………………………………………………………

……………………………………………………………………………………………

- ❖ The heat transfer when thermal equilibrium takes place between a hot and a cold object.

……………………………………………………………………………………………

- ❖ The kinetic energy of molecules of a matter when it becomes warmer.

……………………………………………………………………………………………

- ❖ The temperature of a piece of metal when you hit it several times with a hammer.

……………………………………………………………………………………………

Look at the following graphs which show the temperatures of two substances before and after mixing them together, then answer the questions below:

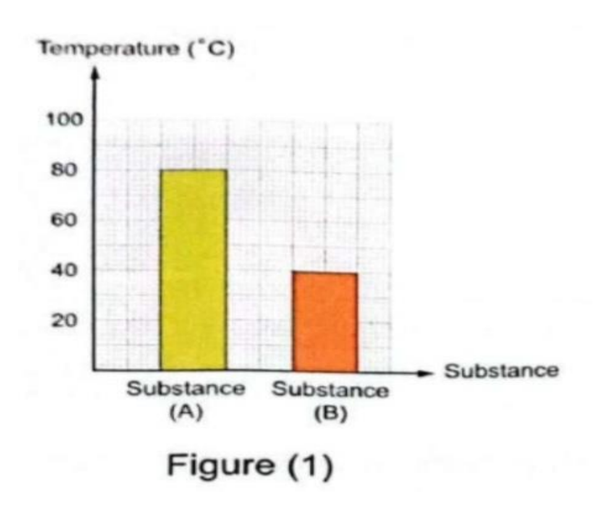


Figure (1)

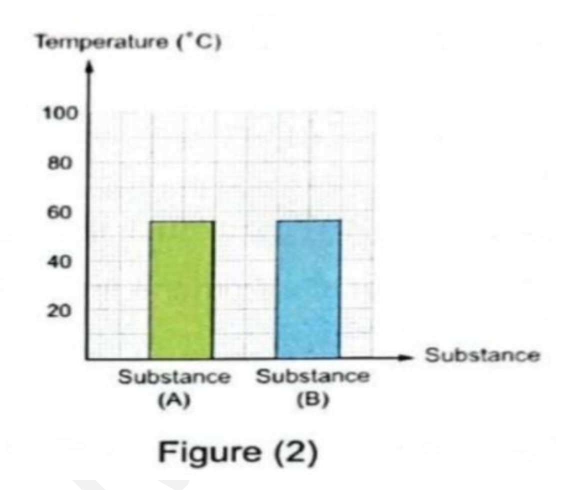


Figure (2)

(A) Complete :

- Figure (........) represents the mixture at thermal equilibrium.
- In figure (1) molecules of substance (.........) move slower than that of substance (.........).
- In figure (2) molecules of substance (........) move slower after mixing, while molecules of substance (..........) move faster after mixing.

(B) Choose:

- According to figure (1), the final temperature of substance (A) and substance (B) will be between ....°C and ....°C
  a. 20 - 40 b. 40 - 80 c. 80 - 100 d. 10 – 20

- The temperature at thermal equilibrium of two substances may equal ....°C
  a. 40 b. 80 c. 56 d. 120

Lesson 3

Choose the correct answer:

1. Heat is transferred through solids by …………………
   a. radiation only   c. conduction only
   b. conduction and convection   d. radiation and convection

2. Heat is transferred by convection through ………………………
   a. solids only   c. space only
   b. solids and gases   d. liquids and gases

3. Heat is transferred by radiation through …………………
   a. solids only   c. liquids only
   b. solids and liquids   d. gases and space

4. In the opposite figure, heat transfers between the two metal cubes from cube (………) to cube (……..) by ……………
   a. A – B – conduction   c. B – A – conduction
   b. A – B – convection   d. B – A - convection

(A) (B)
50°C 20°C
Metal cubes

5. Metals …………………
   a. don't allow heat to flow through them
   b. allow heat to flow through them
   c. are heat insulators
   d. are bad conductors of heat

6. Meteorologists are scientists who study ………………..
   a. weather   b. rocks   c. water   d. cells

7. Heat transfers from a hot slide in a sunny day to your hand by …………… when you touch it.
   a. radiation only   c. conduction only
   b. radiation and convection   d. conduction and convection

8. Heat transfers from an electric heater to your body by ………… when you stand near by it.
   a. radiation only c. conduction only
   b. radiation and conduction d. conduction and convection

9. Heat is transferred through copper and iron by……
   a. radiation only c. conduction only
   b. radiation and convection d. conduction and convection

10. Thermal energy transfers from the sun to us through the space by ………………..
   a. radiation only c. conduction only
   b. radiation and conduction d. convection and conduction

11. Thermal insulators …………………
   a. can prevent the transfer of heat completely through them
   b. slow down the heat transfer through them
   c. allow heat to travel freely through them
   d. increase the speed of heat transfer through them

12. All the following materials are considered thermal conductors, except ……………………
   a. copper b. iron c. wood d. aluminum

13. When you heat water in a pot, molecules of ……………..
   a. hotter water move down and that of cooler water move up
   b. hotter water move up and that of cooler water move down
   c. hotter water stop moving
   d. hotter water not be affected

Choose from column (B) what suits it in column (A):

(A)	(B)
1. Heat is transferred when you touch a hot metallic ball by ………… 2. Heat is transferred from the sun to us through the space by ……….. 3. Heat is transferred between molecules of boiling water by ……….	a. radiation b. convection c. freezing d. conduction

Put (√) or (X):

1- Heat transfers by conduction through solids only. ( )
2- Heat is transferred from the sun to the Earth through the space by convection. ( )
3- Heat is transferred through solids and liquids by convection. ( )
4- When you boil water in a pot, hotter water moves up while cooler water moves down. ( )
5- The speed of heat transfer between objects increases when the difference in temperature between objects increases. ( )
6- Meteorologists are scientists who study weather. ( )
7- Metals such as copper and iron allow heat to travel freely through them. ( )
8- Plastic and wood resist and slow down the heat transfer through them. ( )
9- Air and glass can prevent the transfer of heat completely. ( )
10- Copper and iron allow heat to travel freely through them. ( )

Write the scientific term of each of the following:

- The way by which the heat is transferred through solids only.

  (…………………………….)

- The way by which the heat is transferred through liquids and gases. (………………………………)

- The way by which the heat is transferred through gases and space. (………………………………)

- They are scientists who study the weather.

  (………………………………)

- They are materials that allow heat to travel freely through them. (………………………………)

- They are materials that slow down the heat transfer through them. (………………………………)

Complete the following sentences:

1) Heat can transfer by three different methods, which are ……………………… , …………………….. and …………………….
2) Heat is transferred through solids by …………………… , while through gases and liquids by ……………………..
3) The heat is transferred from the sun to us through the space by ………………………, while heat is transferred through copper by ………………..
4) When you boil water in a pot, the molecules of …………………. water at the bottom of the pot move up and the

………………… of cooler water at the surface of the pot move ………………………

5) The speed of heat transfer between objects …………………… when the surface area of objects increases.
6) Plastic is a thermal ……………. conductor of heat, while copper is a thermal ……………… conductor of heat.
7) Thermal …………………….. materials allow heat to travel freely through them, such as ……………………. and ……………………
8) Thermal …………………… materials slow down the heat transfer through them, such as ………………….. and ……………………

Cross out the odd word:

- Conduction – Convection – Friction – Radiation (………………….)
- Plastic - Copper – Iron – Aluminum (………………….)
- Air - Copper - Wood – Glass (………………….)

Give reasons for:

- You feel the heat of the sun, although there is a space between the sun and Earth.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Aluminum and copper are good conductors of heat.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Glass and wood are bad conductors of heat.

……………………………………………………………………………………………

……………………………………………………………………………………………

What happens if…:

- You touch a hot metal spoon placed in a hot cup of tea.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Increasing the time of contact between two objects with different temperatures.

……………………………………………………………………………………………

……………………………………………………………………………………………

Look at the opposite figure then choose the correct answer:

A. Heat transfers through water molecules by ……………..

   a. convection   c. freezing
   b. conduction   d. radiation

B. Heat transfers through aluminum rod by…………

   a. convection   c. boiling
   b. conduction   d. radiation

C. ……………. and ……………… rods slow down the heat transfer through them.

a. Iron – wood c. Iron - aluminum
b. Plastic – wood d. Plastic - aluminum

D. ………… and …………… rods are good conductors of heat.

a. Iron – wood c. Iron – aluminum
b. Plastic – wood d. Plastic - aluminum

Lesson 4

Choose the correct answer:

1. When you put a plastic cup of water in a freezer, the water freezes and its mass ………………

   a. decreases c. decreases to half
   b. increases d. doesn't change

2. Matter …………….., it just changes from one state to another.

   a. neither be created nor destroyed
   b. can be created and destroyed
   c. can't be created but destroyed
   d. can be created but can't destroyed

3. When you melt 100 grams of chocolate bar, its mass after melting is ……….. 100 grams.

   a. a lot less than c. a little more than
   b. a lot more than d. equal to

4. Matter can be changed from one state to another, ………..

   a. by losing the thermal energy only
   b. by gaining the thermal energy only
   c. by losing or gaining the thermal energy

d. by keeping the thermal energy without change

5. …………. is the best material to make handles of cooking pots, as it doesn't warm fast.
   a. Iron b. Plastic c. Wood d. Copper

6. The mass of a substance doesn't change when this substance changes from one state into another, this is the law of conservation of ………….
   a. mass b. energy c. volume d. state

7. When you freeze some amount of water, it changes from …………….. state to ……………….. state and its mass …………..
   a. solid – liquid - doesn't change
   b. liquid – solid - doesn't change
   c. gaseous – solid – increases
   d. solid - gaseous – decreases

8. According to the opposite figure, which of the following sentences is correct? ………………
   a. Temperature of point (A) is higher than that of point (B).
   b. Temperature of point (B) is higher than that of point (A).
   c. Points (A) and (B) have the same temperature.
   d. Temperature of the handle is higher than the pot.

Put (√) or (x):

1- Matter can't be changed from one form to another. ( )

2- Matter is not destroyed, but it can change its state. ( )

3- The mass of chocolate bar before melting equals to its mass after melting. (   )

4- Matter changes its state by gaining or losing thermal energy. (   )

5- If you put some juice in a freezer, it changes into gaseous state and its mass doesn't change. (   )

6- When water freezes, it loses thermal energy. (   )

7- The temperature increases when we go far away the source of heat. (   )

8- Plastic is better than wood in making the handle of cooking pots. (   )

9- Wood is warm faster than plastic. (   )

Write the scientific term of each of the following:

- The mass of a substance doesn't change when this substance changes from one state into another.

  (………………………..)

- A form of energy that gained or lost by the matter to change its state. (…………………………)

Complete the following sentences:

1) When chocolate bar melts, it changes from ……………… state to ……………… state by gaining …………………. energy.
2) When a matter changes from one state to another, its ………………… doesn't change.
3) The mass of ice cream before melting is ……………. its mass after melting.

4) Matter neither be ……………… nor …………………… , but it just ………………. from one form to another.

5) Thermal insulating materials such as ………………. and ………………. are used to make handles of pots.

<u>Give reasons for:</u>

- The mass of ice cubes before melting equals to their mass after melting.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Decreasing of mass of popcorn grains which have some moisture, after cooking them.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Plastic is better than wood to make the handle of cooking pots.

……………………………………………………………………………………………

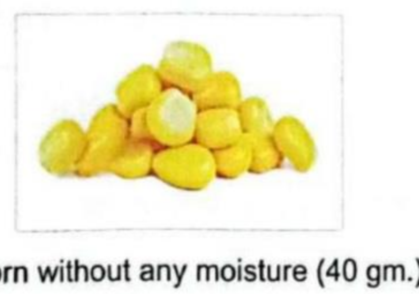
……………………………………………………………………………………………

<u>What happens to…:</u>

❖ The mass of a piece of butter after melting it.

……………………………………………………………………………………………

Which one has mass a little than 40 gm. After cooking? (Give a reason for your answer):



Popcorn without any moisture (40 gm.)
Figure (1)



Popcorn with some moisture (40 gm.)
Figure (2)

……

……

Look at the following figures, then complete the sentences below:

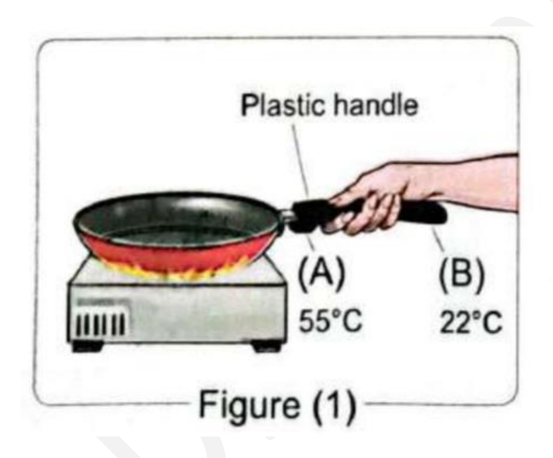


Figure (1)

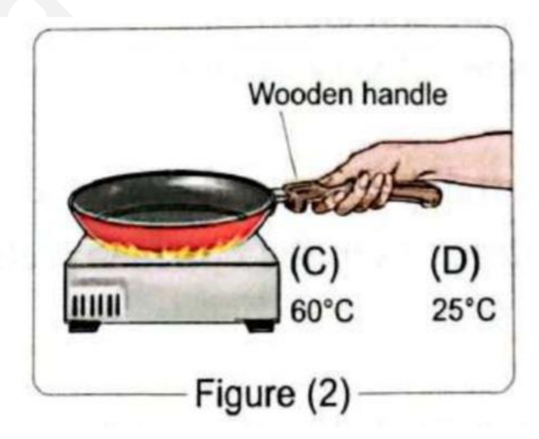


Figure (2)

- The handle in figure (…….) warms up faster than the handle in figure (………).
- In the two figures, points (………) and (……..) have the highest temperatures.
- In the two figures, points (………) and (………) have the lowest temperatures.

Lesson 5

Choose the correct answer:

1. When an object stops on the top of a ramp it stored …………… energy.
   a. kinetic   b. light   c. potential   d. sound

2. When a car goes down on a ramp, its …………. energy changes to ……………….. energy.
   a. kinetic – potential   c. sound – potential
   b. potential – kinetic   d. light - potential

3. Due to the friction between a moving object and a flat road the ……………. energy of the moving object changes into ……………… energy.
   a. kinetic – thermal   c. potential – thermal
   b. thermal – kinetic   d. kinetic - potential

4. Due to the friction force between a moving object and a flat road, the speed of a moving object …………
   a. decreases then increases   c. decreases
   b. not be affected   d. increases

5. If there are a small car and a truck move down on the same ramp, ……………….
   a. the car moves faster than the truck
   b. the car and the truck move with the same speed
   c. the truck moves slower than the car
   d. the truck moves faster than the car

6. If the mass of an object moves down on a ramp …………. , its speed will ……………….
   a. decreases – increases   c. increases – increases

b. increases – decreases d. not change – decreases

7. When a marble goes down on a ramp, its stored potential energy ………………
   a. increases c. changes into kinetic energy
   b. doesn't change d. changes into light energy

Put (√) or (x):

1- Energy can be stored in the form of kinetic energy inside an object. ( )
2- When you go down on a slide, your stored kinetic energy changes into potential energy. ( )
3- Due to the friction force, thermal energy of a moving object changes into kinetic energy. ( )
4- Friction increases the speed of moving objects. ( )
5- A heavier object moves faster than a lighter object when they go down on the same ramp. ( )
6- When a marble goes down on a ramp, its potential energy increases. ( )
7- A moving car has potential energy, while stopping car has kinetic energy. ( )

Write the scientific term of each of the following:

- A form of energy stored in an object when it is placed on the top of a ramp. (…………………………..)
- The energy that the object gains when it moves down on a ramp. (…………………………..)
- The energy that potential energy changes into when an object moves down on a ramp. (……………………………)

- The energy that kinetic energy changes into when a moving object is affected by friction. (……………………………)

Complete the following sentences:

1) Energy can …………….. from one form to another.
2) When a car moves down a hill its .... energy changes into ………………….. energy.
3) Friction between a moving car and a road causes changing of its …………………. energy into .... energy.
4) Friction causes decreasing the ……………………… of a moving object and decreasing its …………………… energy.
5) When the mass of a moving object that moves down on a slide ……………………. , its speed increases.
6) Some of kinetic energy of a moving object changes into thermal energy due to …………………… force.

Give reasons for:

- Due to friction force, the tires of a moving car becomes hot.

………………………………………………………………………………………………

………………………………………………………………………………………………

- A truck is faster than a small car, when both of them move down on the same ramp.

………………………………………………………………………………………………

………………………………………………………………………………………………

What happens to…:

❖ The stored energy of a stopped object when it moves down on a slide.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

❖ The speed of a moving object when it is affected by friction.

…………………………………………………………………………………………………

Look at the following picture, then complete the sentences using the words below:

(**kinetic – potential – thermal – friction**)

- When the toy car is at the top of the slide, it stores ……………………… energy.
- When the toy car goes down on the slide, its potential energy changes into ……………………… energy.
- When the toy car reaches the end of the slide, it may stop after a while due to ………………… force which changes its kinetic energy into …………………… energy.

Lesson 6

Choose the correct answer:

1. To make clothes, we can use ....
   a. steel b. concrete c. hard fabric d. flexible fabric

2. Plastic ....
   a. is a liquid material
   b. burns easily
   c. is originated from petroleum
   d. is a gaseous material

3. To make bridges, we can use …………………
   a. flexible fabric b. concrete c. smart clothes d. glass

4. Concrete ....
   a. becomes liquid after it dries
   b. consists of rock, sand and water
   c. controls your body temperature
   d. is originated from petroleum

5. All the following are properties of petroleum, <u>except</u> ……………..
   a. it is a liquid material
   b. it often resists burning
   c. it burns easily
   d. it is an original material of plastic

6. Shrink-wrap is created when we ....
   a. add heat to steel
   b. cooling glass
   c. cooling steel
   d. add heat to plastic

7. All the following materials are liquid materials, <u>except</u> ....
   a. petroleum
   b. glass before cooling
   c. plastic
   d. concrete before drying.

8. Limestone is considered from the components of ....
   a. plastic b. shrink-wrap c. smart cloth d. glass

9. All the following are properties of smart clothes, except they ………………………
    a. control your body temperature
    b. are made of concrete
    c. light up in the dark
    d. keep themselves clean.

10. Smart clothes control your body ………………
    a. mass   b. volume   c. temperature   d. structure

11. All the following are properties of steel, except ………………
    a. it is a mixture of rock and sand
    b. it is a mixture of iron and other elements
    c. it is strong material
    d. it lasts for a long time

Choose from column (B) what suits it in column (A):

(A)	(B)
1. Smart cloth 2. Steel 3. Concrete 4. Chemical change	a. is a mixture of iron and other elements. b. can light up in the dark. c. is used to create plastic from petroleum. d. is created by adding heat to plastic. e. is a mixture of rock, sand and water.

Put (√) or (x):

1- Every material is useful for all purposes. ( )
2- Flexible fabric is used in making cloth. ( )

3- We can make a car by using cloth. ( )

4- Smart clothes can control the temperature of the human body. ( )

5- Smart clothes can keep themselves clean. ( )

6- Concrete and steel are used in making clothes. ( )

7- Smart clothes can light up in dark places. ( )

8- Studying chemical structure of any material help us to know its properties. ( )

9- Concrete is made of water and iron. ( )

10- Concrete becomes a liquid material after it dries. ( )

11- Steel is made by chemical change of plastic. ( )

12- Plastic often resists burning. ( )

<u>Write the scientific term of each of the following:</u>

- A type of clothes keep themselves clean.

  (…………………………..)

- A material is made of a mixture of iron and other elements.

  (…………………………..)

- A mixture of rock, sand and water which becomes hard after it dries. (……………………………)

- A material is made by chemical change of some compounds of petroleum. (……………………………)

- It is the original material of plastic. (……………………………)

- A material that is used in making shrink-wrap.

  (…………………………….)

- A material consists of sand, limestone and soda ash.

  (…………………………….)

Complete the following sentences:

1) Smart clothes can ………………… in the dark and keep themselves ……………………
2) Steel is made of a mixture of ………………… and other elements, while concrete is made of a mixture of rock, ………………… and …………………
3) Concrete is in ……………….. state when it is formed, while after it dries, it becomes in ……………….. state.
4) Concrete is used as the base of ………………… and ……………….. as it is very strong.
5) Plastic is made by ………………….. change of some compounds of …………………..
6) Glass is a mixture of ………………….. , ………………… and sodium carbonate.
7) Petroleum is a liquid material, while plastic is …………………… material.
8) Chemical change of some compounds of petroleum is used in making ……………………

Give reasons for:

- Smart clothes have many benefits.

………………………………………………………………………………………………

………………………………………………………………………………………………

- Properties of plastic are different from properties of petroleum.

……………………………………………………………………………………………

……………………………………………………………………………………………

- Scientists should study the structure of molecules of different materials.

……………………………………………………………………………………………

……………………………………………………………………………………………

<u>What happens if…:</u>

- You are wearing smart clothes in a dark place.

……………………………………………………………………………………………

- Mixing rock, sand and water together.

……………………………………………………………………………………………

- Making chemical change to some compounds of petroleum.

……………………………………………………………………………………………

- Mixing sand, limestone and soda ash at high temperature.

……………………………………………………………………………………………

- Concrete is left to dry.

……………………………………………………………………………………………

Look at the opposite picture, then put (√) or (x):

- Concrete is made of water and plastic. (   )
- Concrete stays in the liquid state after it dries. (   )
- Concrete is created by adding high temperature to plastic. (   )
- Concrete is considered a flexible fabric. (   )

Unit 2 – concept 2 - answers

Lesson 1

Choose the correct answer:

1. Any matter has thermal energy, because ....
   a. its molecule always move
   b. it has fixed shape
   c. its molecules don't move
   d. it has fixed volume

2. If heat transfers to a lower temperature object, its molecules will ....
   a. stop moving   c. move faster
   b. move slower   d. not be affected

3. Heat transfers from .... object to .... object.
   a. cooler – hotter   c. bigger – smaller
   b. hotter – cooler   d. smaller - bigger

4. The handle of an electric iron is made of ....
   a. iron
   b. thermal insulator material
   c. metal
   d. thermal conductor material.

5. All the following are properties of heat, except ....
   a. it is an essential component of life on Earth
   b. it cannot be lost but it is only transferred
   c. it flows from a cooler object to a hotter object
   d. it flows from a hotter object to a cooler object

6. If you stand on hot sand in bare feet, you will feel the hotness of the sand because ....
   a. heat transfers from your legs to sand
   b. heat transfers from sand to your legs
   c. your legs are hotter than sand
   d. your legs and sand have the same temperature

7. If you hold an ice cube in your hand, which of the following sentences is correct? ....
   a. Your hand temperature is lower than the ice temperature.
   b. The ice temperature is higher than your hand temperature.
   c. The ice and your hand have the same temperature.
   d. The molecules of ice will start to move faster.

<u>Choose from column (B) what suits it in column (A):</u>

(A)		(B)
1. plastic	b	a. is an essential component of life on Earth.
2. metal	c	b. is used to make the electric iron handle.
3. heat	a	c. is a thermal conductor.
		d. is the measuring unit of volume.

<u>Put (√) or (x):</u>

1- When objects with the same temperature touch each other, heat transfer takes place. (X)
2- Heat transfers from the cooler object to the hotter object. (X)
3- The molecules of the hotter object move slower than that of the cooler object. (X)
4- Thermal conductors are good conductors of heat. (√)
5- Plastic resists the transfer of thermal energy. (√)

6- In electric iron heat transfers from cloth to iron. (**X**)

7- Heat transfers between two objects that have the same temperature. (**X**)

8- Thermal energy relates to the total sum of the kinetic energy of substance's atoms and molecules. (**√**)

9- Molecules of cold or hot substances always move. (**√**)

Write the scientific term of each of the following:

- They are materials that allow thermal energy to transfer through. (**thermal conductor materials**)
- They are materials that resist the transfer of thermal energy. (**thermal insulator materials**)
- Thermal insulator material used to make the handle of an electric iron. (**plastic**)
- Thermal conductor material used to make lower part of an electric iron that is used in ironing clothes. (**iron**)

Complete the following sentences:

1) When objects with different temperatures come in contact with each other **heat** transfer takes place.
2) Heat transfers from objects with **higher** temperature to objects with **lower** temperature.
3) If you hold a cup of cold water, heat transfers from **the hand** to **the cup**.
4) Molecules of warmer matter move **faster** than molecules of cooler matter.
5) When a cat stands on a car in a sunny day, its legs absorb **thermal** energy that is released from the car.
6) There are two types of materials according to their ability to transfer thermal energy which are **thermal conductor** and **thermal insulator** materials.
7) The handle of an electric iron may be made of **plastic**, while **iron** is used to make lower part that is used in ironing clothes.

8) The handle of cooking pot must be made of thermal **insulator** materials.
9) Thermal energy relates to the total sum of the **kinetic** energy of substance's atoms and **molecules**.

Give reasons for:

- The handle of an electric iron is made of plastic.
  - **Because plastic is a thermal insulator that doesn't allow heat to transfer through it.**

- The lower part of an electric iron is made of iron.
  - **Because iron is a thermal conductor that allows heat to transfer through it.**

- You feel heat, when you touch a metal spoon placed in a hot cup of tea.
  - **Because the temperature of the metal spoon is higher than the hand so the heat transfers from the metal spoon to the hand.**

What happens to …:

- The molecules' movement of a lizard's skin when it stands on a rock in a sunny day.
  - **The molecules of lizard's skin absorb thermal energy that releases from the rock, and they will move faster.**

Look at the following figures that show two different objects, then complete the sentences below:

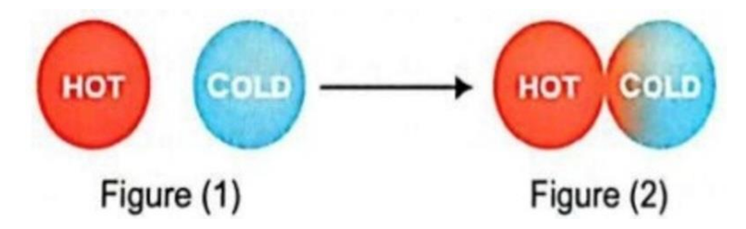


Figure (1) Figure (2)

A. In figure (2), heat transfers from **hot** object to **cold** object.

B. In figure (1) molecules of cold object move **slower** than molecules of hot object.

Look at the figures below, then answer the questions:

- In which figure the hand will feel heat? **Figure (a)**
- Give a reason for your answer.
  - **because iron is a thermal conductor that allows heat to transfer through it.**

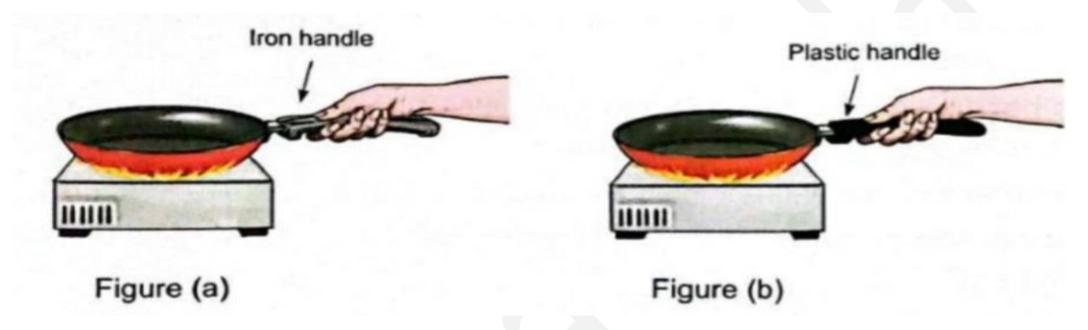


Figure (a) Figure (b)

Lesson 2

Choose the correct answer:

1. The average temperature is almost ……………….. the final temperature of the mixture of two substances with different temperatures at the thermal equilibrium.
   a. more than b. less than c. equal to d. double

2. If you pour a cup of water with temperature 30°C to another cup of water with temperature 80°C, the final temperature of the mixture may be …………….
   a. 80°C b. 30°C c. 50°C d. 110°C

3. The final temperature of two mixed substances with different temperatures is less than that of the ……………. substance and greater than that of the ………………….. substance.
   a. hotter - cooler c. bigger - smaller

b. cooler – hotter d. smaller – bigger

4. After mixing two substances with different temperatures, the molecules of the cooler substance ………………
   a. will move faster c. will move slower
   b. will not be affected d. will stop moving

5. In the opposite figure, if some thermal energy of mixture transfers to the cup, the final temperature of this mixture will be …………… the average temperature.
   a. equal to c. more than
   b. double d. less than

Tea
70°C
Milk
30°C

6. ………………. occurs when heat transfer stops between two objects as they read the same temperature.
   a. Calorie c. Sound equilibrium
   b. Heat flow d. Thermal equilibrium

7. The measuring unit of heat is called …………………
   a. calorie b. kilogram c. gram d. meter

8. Hitting a piece of metal several times by a hammer causes ……………………..
   a. the temperature of the metal becomes lower
   b. molecules of the metal move slower
   c. molecules of the metal move faster
   d. The metal becomes cooler

9. On heating a substance, the ……………. of its molecules ………………
   a. kinetic energy – decreases c. kinetic energy - increases
   b. temperature – decreases d. movement – decreases

Put (√) or (x):

1- When mixing two substances with different temperatures, their average temperature is lower than their final temperature. (**X**)

2- After mixing two substances with different temperatures the molecules movement of the cooler substance becomes slower. (**X**)

3- The final temperature of two mixed substances with different temperatures is between the temperatures of hotter and cooler substances. (**√**)

4- The temperature of a hotter substance increases after it is mixed with a cooler substance. (**X**)

5- When you add some cool water to hot tea the molecules of tea will move slower. (**√**)

6- When kinetic energy of molecules decreases, they vibrate slower. (**√**)

7- Heat is measured in calorie. (**√**)

8- Thermal equilibrium means that the objects in contact reach the same temperature. (**√**)

Write the scientific term of each of the following:

- It occurs when heat transfer stops between two objects reach the same temperature. (**thermal equilibrium**)
- It is the measuring unit of heat. (**calorie**)

Complete the following sentences using the words below:

(**thermal equilibrium – faster – equals – hotter – cooler**)

1) When you mix two substances with different temperatures, their final temperature at thermal equilibrium almost **equals** their average temperature.
2) Molecules of cooler substance move **faster** after mixing it with hotter substance.

3) The final temperature of two mixed substances with different temperatures is between the temperature of the **hotter** substance and the temperature of the **cooler** substance.
4) When mixing two substances with different temperatures, they reach the same temperature at **thermal equilibrium**.

Give reasons for:

- Sometimes the final temperature of a mixture of two substances with different temperatures is less than their average temperature.
  - **Because some of thermal energy transfers to the air or to the container.**

- Heat transfer stops after a while between two mixed substances with different temperatures.
  - **Because two substances reach to the same temperature at thermal equilibrium.**

- After mixing two substances with different temperatures the molecules of the hotter substance move slower.
  - **Because after mixing, the molecules' temperature of hotter substance decreases.**

- The vibration of molecules of a matter increases when it becomes warmer.
  - **Because when a matter becomes warmer, the kinetic energy of its molecules increases so their vibration increases.**

What happens to...:

- Molecules' movement of a hotter substance after mixing it with a cooler substance.
  - **The movement of molecules of the hotter substance becomes slower after mixing.**

- The heat transfer when thermal equilibrium takes place between a hot and a cold object.
    - **The heat transfer will stop.**

- The kinetic energy of molecules of a matter when it becomes warmer.
    - **The kinetic energy will increase.**

- The temperature of a piece of metal when you hit it several times with a hammer.
    - **The temperature of a piece of metal will increase.**

<u>Look at the following graphs which show the temperatures of two substances before and after mixing them together, then answer the questions below:</u>

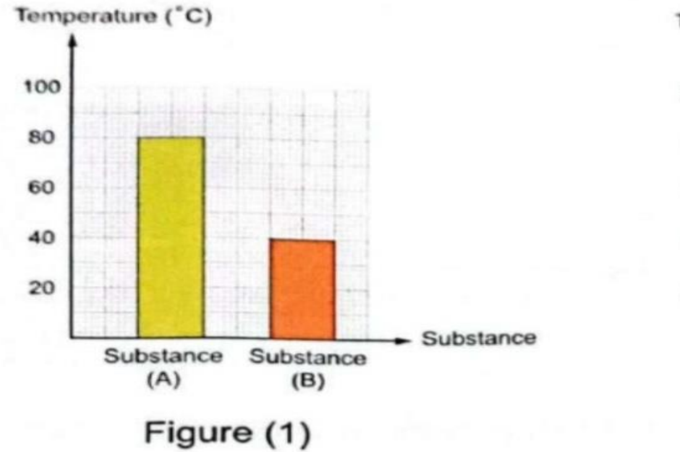


Figure (1)

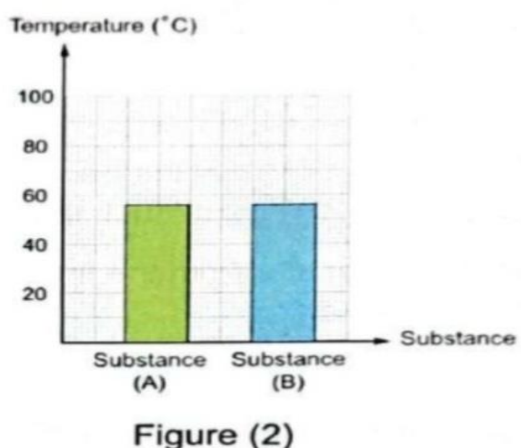


Figure (2)

(A) <u>Complete :</u>

- Figure (**2**) represents the mixture at thermal equilibrium.
- In figure (1) molecules of substance (**B**) move slower than that of substance (**A**).
- In figure (2) molecules of substance (**A**) move slower after mixing, while molecules of substance (**B**) move faster after mixing.

(B) <u>Choose:</u>

- According to figure (1), the final temperature of substance (A) and substance (B) will be between ……..°C and ……..°C

a. 20 - 40 b. 40 - 80 c. 80 - 100 d. 10 – 20

➢ The temperature at thermal equilibrium of two substances may equal ....°C

a. 40 b. 80 c. 56 d. 120

Lesson 3

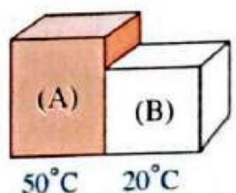
Choose the correct answer:

1. Heat is transferred through solids by ....
   a. radiation only
   b. conduction and convection
   c. conduction only
   d. radiation and convection

2. Heat is transferred by convection through ....
   a. solids only
   b. solids and gases
   c. space only
   d. liquids and gases

3. Heat is transferred by radiation through ....
   a. solids only
   b. solids and liquids
   c. liquids only
   d. gases and space

4. In the opposite figure, heat transfers between the two metal cubes from cube (........) to cube (........) by ....
   a. A – B – conduction
   b. A – B – convection
   c. B – A – conduction
   d. B – A - convection



Metal cubes

5. Metals ....
   a. don't allow heat to flow through them
   b. allow heat to flow through them
   c. are heat insulators
   d. are bad conductors of heat

6. Meteorologists are scientists who study ....
   a. weather   b. rocks   c. water   d. cells

7. Heat transfers from a hot slide in a sunny day to your hand by .... when you touch it.
   a. radiation only   c. conduction only
   b. radiation and convection   d. conduction and convection

8. Heat transfers from an electric heater to your body by .... when you stand near by it.
   a. radiation only   c. conduction only
   b. radiation and conduction   d. conduction and convection

9. Heat is transferred through copper and iron by......
   a. radiation only   c. conduction only
   b. radiation and convection   d. conduction and convection

10. Thermal energy transfers from the sun to us through the space by ....
    a. radiation only   c. conduction only
    b. radiation and conduction   d. convection and conduction

11. Thermal insulators ....
    a. can prevent the transfer of heat completely through them
    b. slow down the heat transfer through them
    c. allow heat to travel freely through them
    d. increase the speed of heat transfer through them

12. All the following materials are considered thermal conductors, except ....
    a. copper   b. iron   c. wood   d. aluminum

13. When you heat water in a pot, molecules of ....

a. hotter water move down and that of cooler water move up
b. hotter water move up and that of cooler water move down
c. hotter water stop moving
d. hotter water not be affected

Choose from column (B) what suits it in column (A):

(A)	(B)
1. Heat is transferred when you touch a hot metallic ball by .... **d** 2. Heat is transferred from the sun to us through the space by .... **a** 3. Heat is transferred between molecules of boiling water by .... **b**	a. radiation b. convection c. freezing d. conduction

Put (√) or (X):

1- Heat transfers by conduction through solids only. (**√**)
2- Heat is transferred from the sun to the Earth through the space by convection. (**X**)
3- Heat is transferred through solids and liquids by convection. (**X**)
4- When you boil water in a pot, hotter water moves up while cooler water moves down. (**√**)
5- The speed of heat transfer between objects increases when the difference in temperature between objects increases. (**√**)
6- Meteorologists are scientists who study weather. (**√**)
7- Metals such as copper and iron allow heat to travel freely through them. (**√**)
8- Plastic and wood resist and slow down the heat transfer through them. (**√**)
9- Air and glass can prevent the transfer of heat completely. (**X**)

10- Copper and iron allow heat to travel freely through them. (**√**)

Write the scientific term of each of the following:

- The way by which the heat is transferred through solids only. (**conduction**)
- The way by which the heat is transferred through liquids and gases. (**convection**)
- The way by which the heat is transferred through gases and space. (**radiation**)
- They are scientists who study the weather. (**meteorologists**)
- They are materials that allow heat to travel freely through them. (**thermal conductors**)
- They are materials that slow down the heat transfer through them. (**thermal insulators**)

Complete the following sentences:

1) Heat can transfer by three different methods, which are **conduction**, **convection** and **radiation**.
2) Heat is transferred through solids by **conduction**, while through gases and liquids by **convection**.
3) The heat is transferred from the sun to us through the space by **radiation**, while heat is transferred through copper by **conduction**.
4) When you boil water in a pot, the molecules of **hotter** water at the bottom of the pot move up and the **molecules** of cooler water at the surface of the pot move **down**.
5) The speed of heat transfer between objects **increases** when the surface area of objects increases.
6) Plastic is a thermal **bad** conductor of heat, while copper is a thermal **good** conductor of heat.

7) Thermal **conductors** materials allow heat to travel freely through them, such as **iron** and **copper**.
8) Thermal **insulators** materials slow down the heat transfer through them, such as **plastic** and **wood**.

Cross out the odd word:

- Conduction – Convection – **Friction** – Radiation (**friction**)
- **Plastic** - Copper – Iron – Aluminum (**plastic**)
- Air - **Copper** - Wood – Glass (**copper**)

Give reasons for:

- You feel the heat of the sun, although there is a space between the sun and Earth.
  - **Because the heat transfers through the space by radiation.**

- Aluminum and copper are good conductors of heat.
  - **Because they allow heat to travel freely through them.**

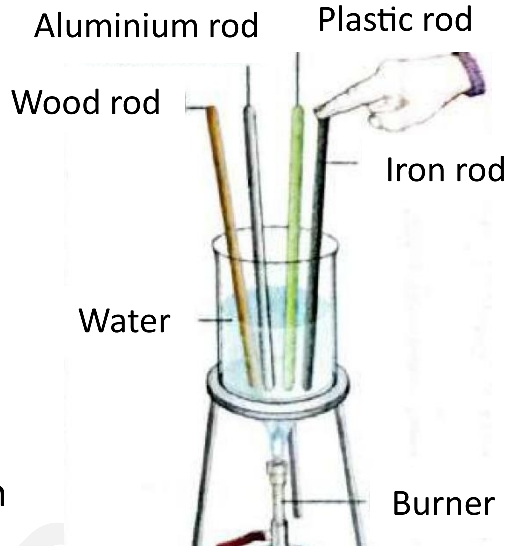
- Glass and wood are bad conductors of heat.
  - **Because they slow down the transfer of heat through them.**

What happens if…:

- You touch a hot metal spoon placed in a hot cup of tea.
  - **Heat transfers from the spoon to your hand by conduction.**

- Increasing the time of contact between two objects with different temperatures.
  - **The speed of heat transfer between two objects increases.**

Look at the opposite figure then choose the correct answer:



A. Heat transfers through water molecules by ……………..

a. convection c. freezing
b. conduction d. radiation

B. Heat transfers through aluminum rod by…………

a. convection c. boiling
b. conduction d. radiation

C. ……………. and …………….. rods slow down the heat transfer through them.

a. Iron – wood c. Iron - aluminum
b. Plastic – wood d. Plastic - aluminum

D. ………… and …………… rods are good conductors of heat.

a. Iron – wood c. Iron – aluminum
b. Plastic – wood d. Plastic – aluminum

Lesson 4

Choose the correct answer:

1. When you put a plastic cup of water in a freezer, the water freezes and its mass ………………

a. decreases c. decreases to half
b. increases d. doesn't change

2. Matter ……………., it just changes from one state to another.

a. neither be created nor destroyed
b. can be created and destroyed

c. can't be created but destroyed
d. can be created but can't destroyed

3. When you melt 100 grams of chocolate bar, its mass after melting is ……….. 100 grams.
   a. a lot less than
   b. a lot more than
   c. a little more than
   d. equal to

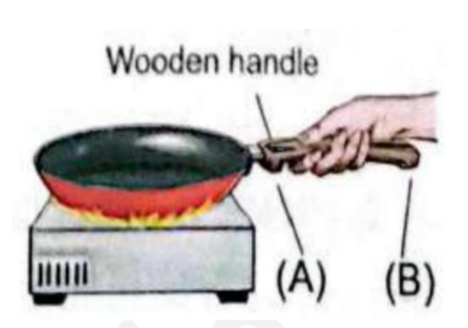
4. Matter can be changed from one state to another, ………..
   a. by losing the thermal energy only
   b. by gaining the thermal energy only
   c. by losing or gaining the thermal energy
   d. by keeping the thermal energy without change

5. ………… is the best material to make handles of cooking pots, as it doesn't warm fast.
   a. Iron
   b. Plastic
   c. Wood
   d. Copper

6. The mass of a substance doesn't change when this substance changes from one state into another, this is the law of conservation of …………
   a. mass
   b. energy
   c. volume
   d. state

7. When you freeze some amount of water, it changes from ……………. state to ………………. state and its mass ………….
   a. solid – liquid - doesn't change
   b. liquid – solid - doesn't change
   c. gaseous – solid – increases
   d. solid - gaseous – decreases

8. According to the opposite figure, which of the following sentences is correct? ……………….



   a. Temperature of point (A) is higher than that of point (B).
   b. Temperature of point (B) is higher than that of point (A).
   c. Points (A) and (B) have the same temperature.
   d. Temperature of the handle is higher than the pot.

Put (√) or (x):

1- Matter can't be changed from one form to another. (**X**)
2- Matter is not destroyed, but it can change its state. (**√**)
3- The mass of chocolate bar before melting equals to its mass after melting. (**√**)
4- Matter changes its state by gaining or losing thermal energy. (**√**)
5- If you put some juice in a freezer, it changes into gaseous state and its mass doesn't change. (**X**)
6- When water freezes, it loses thermal energy. (**√**)
7- The temperature increases when we go far away the source of heat. (**X**)
8- Plastic is better than wood in making the handle of cooking pots. (**√**)
9- Wood is warm faster than plastic. (**√**)

Write the scientific term of each of the following:

- The mass of a substance doesn't change when this substance changes from one state into another. (**law of conservation of mass**)
- A form of energy that gained or lost by the matter to change its state. (**thermal energy**)

Complete the following sentences:

1) When chocolate bar melts, it changes from **solid** state to **liquid** state by gaining **thermal** energy.
2) When a matter changes from one state to another, its **mass** doesn't change.
3) The mass of ice cream before melting is **equal to** its mass after melting.
4) Matter neither be **destroyed** nor **created** , but it just **changes** from one form to another.
5) Thermal insulating materials such as **plastic** and **wood** are used to make handles of pots.

Give reasons for:

- The mass of ice cubes before melting equals to their mass after melting.
  - **According to the law of conservation of mass, the mass of ice cubes doesn't change when ice changes from solid state to liquid state.**

- Decreasing of mass of popcorn grains which have some moisture, after cooking them.
  - **Because of the evaporation of the water during cooking popcorn.**

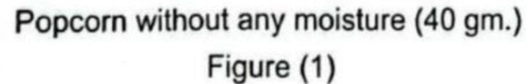
- Plastic is better than wood to make the handle of cooking pots.
  - **Because plastic warms slower than wood.**

What happens to…:

- The mass of a piece of butter after melting it.
  - **Its mass doesn't change.**

Which one has mass a little than 40 gm. After cooking? (Give a reason for your answer):





Popcorn without any moisture (40 gm.)
Figure (1)



Popcorn with some moisture (40 gm.)
Figure (2)

- **Popcorn in figure (2) has a little mass after cooking**
- **Because the evaporation of the water during cooking.**

Look at the following figures, then complete the sentences below:

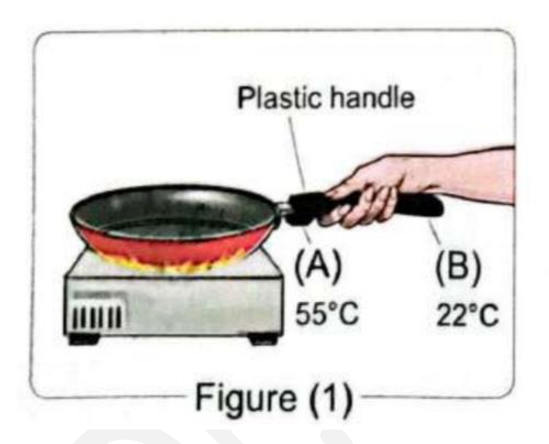


Figure (1)

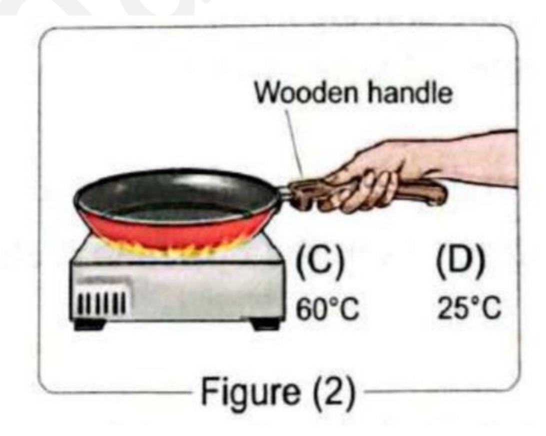


Figure (2)

- The handle in figure (**2**) warms up faster than the handle in figure (**1**).
- In the two figures, points (**A**) and (**C**) have the highest temperatures.
- In the two figures, points (**B**) and (**D**) have the lowest temperatures.

Lesson 5

Choose the correct answer:

1. When an object stops on the top of a ramp it stored ………….. energy.
   a. kinetic   b. light   c. potential   d. sound

2. When a car goes down on a ramp, its …………. energy changes to ………………. energy.
   a. kinetic – potential   c. sound – potential
   b. potential – kinetic   d. light - potential

3. Due to the friction between a moving object and a flat road the …………… energy of the moving object changes into …………….. energy.
   a. kinetic – thermal   c. potential – thermal
   b. thermal – kinetic   d. kinetic - potential

4. Due to the friction force between a moving object and a flat road, the speed of a moving object …………
   a. decreases then increases   c. decreases
   b. not be affected   d. increases

5. If there are a small car and a truck move down on the same ramp, ……………….
   a. the car moves faster than the truck
   b. the car and the truck move with the same speed
   c. the truck moves slower than the car
   d. the truck moves faster than the car

6. If the mass of an object moves down on a ramp …………. , its speed will ……………….
   a. decreases – increases   c. increases – increases

b. increases – decreases d. not change – decreases

7. When a marble goes down on a ramp, its stored potential energy ………………
   a. increases
   b. doesn't change
   c. changes into kinetic energy
   d. changes into light energy

Put (√) or (x):

1- Energy can be stored in the form of kinetic energy inside an object. (**X**)
2- When you go down on a slide, your stored kinetic energy changes into potential energy. (**X**)
3- Due to the friction force, thermal energy of a moving object changes into kinetic energy. (**X**)
4- Friction increases the speed of moving objects. (**X**)
5- A heavier object moves faster than a lighter object when they go down on the same ramp. (**√**)
6- When a marble goes down on a ramp, its potential energy increases. (**X**)
7- A moving car has potential energy, while stopping car has kinetic energy. (**X**)

Write the scientific term of each of the following:

- A form of energy stored in an object when it is placed on the top of a ramp. (**potential energy**)
- The energy that the object gains when it moves down on a ramp. (**kinetic energy**)
- The energy that potential energy changes into when an object moves down on a ramp. (**kinetic energy**)
- The energy that kinetic energy changes into when a moving object is affected by friction. (**thermal energy**)

Complete the following sentences:

1) Energy can **change** from one form to another.
2) When a car moves down a hill its **potential** energy changes into **kinetic** energy.
3) Friction between a moving car and a road causes changing of its **kinetic** energy into **thermal** energy.
4) Friction causes decreasing the **speed** of a moving object and decreasing its **kinetic** energy.
5) When the mass of a moving object that moves down on a slide **increases** , its speed increases.
6) Some of kinetic energy of a moving object changes into thermal energy due to **friction** force.

Give reasons for:

- Due to friction force, the tires of a moving car becomes hot.
  - **Because friction force changes kinetic energy into thermal energy.**

- A truck is faster than a small car, when both of them move down on the same ramp.
  - **Because the truck has mass more than the small car so the truck gains more kinetic energy.**

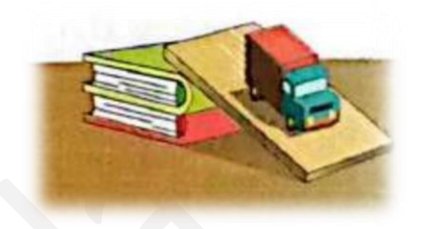
What happens to…:

- The stored energy of a stopped object when it moves down on a slide.
  - **The stored potential energy changes into kinetic energy.**

- The speed of a moving object when it is affected by friction.
  - **The speed will decrease.**

Look at the following picture, then complete the sentences using the words below:

(**kinetic – potential – thermal – friction**)



- When the toy car is at the top of the slide, it stores **potential** energy.
- When the toy car goes down on the slide, its potential energy changes into **kinetic** energy.
- When the toy car reaches the end of the slide, it may stop after a while due to **friction** force which changes its kinetic energy into **thermal** energy.

Lesson 6

Choose the correct answer:

1. To make clothes, we can use ....
   a. steel b. concrete c. hard fabric d. flexible fabric

2. Plastic ....
   a. is a liquid material
   b. burns easily
   c. is originated from petroleum
   d. is a gaseous material

3. To make bridges, we can use ....
   a. flexible fabric b. concrete c. smart clothes d. glass

4. Concrete ....
   a. becomes liquid after it dries
   b. consists of rock, sand and water
   c. controls your body temperature
   d. is originated from petroleum

5. All the following are properties of petroleum, except ....
    a. it is a liquid material
    b. it often resists burning
    c. it burns easily
    d. it is an original material of plastic

6. Shrink-wrap is created when we ....
    a. add heat to steel   c. cooling steel
    b. cooling glass   d. add heat to plastic

7. All the following materials are liquid materials, except ....
    a. petroleum   c. plastic
    b. glass before cooling   d. concrete before drying.

8. Limestone is considered from the components of ....
    a. plastic   b. shrink-wrap   c. smart cloth   d. glass

9. All the following are properties of smart clothes, except they ....
    a. control your body temperature
    b. are made of concrete
    c. light up in the dark
    d. keep themselves clean.

10. Smart clothes control your body ....
    a. mass   b. volume   c. temperature   d. structure

11. All the following are properties of steel, except ....
    a. it is a mixture of rock and sand
    b. it is a mixture of iron and other elements
    c. it is strong material
    d. it lasts for a long time

Choose from column (B) what suits it in column (A):

(A)		(B)
1. Smart cloth 2. Steel 3. Concrete 4. Chemical change	**b** **a** **e** **c**	a. is a mixture of iron and other elements. b. can light up in the dark. c. is used to create plastic from petroleum. d. is created by adding heat to plastic. e. is a mixture of rock, sand and water.

Put (√) or (x):

1- Every material is useful for all purposes. (**X**)
2- Flexible fabric is used in making cloth. (**√**)
3- We can make a car by using cloth. (**X**)
4- Smart clothes can control the temperature of the human body. (**√**)
5- Smart clothes can keep themselves clean. (**√**)
6- Concrete and steel are used in making clothes. (**X**)
7- Smart clothes can light up in dark places. (**√**)
8- Studying chemical structure of any material help us to know its properties. (**√**)
9- Concrete is made of water and iron. (**X**)
10- Concrete becomes a liquid material after it dries. (**X**)
11- Steel is made by chemical change of plastic. (**X**)
12- Plastic often resists burning. (**√**)

Write the scientific term of each of the following:

- A type of clothes keep themselves clean. (**smart clothes**)
- A material is made of a mixture of iron and other elements. (**steel**)

- A mixture of rock, sand and water which becomes hard after it dries. (**concrete**)
- A material is made by chemical change of some compounds of petroleum. (**plastic**)
- It is the original material of plastic. (**petroleum**)
- A material that is used in making shrink-wrap. (**plastic**)
- A material consists of sand, limestone and soda ash. (**glass**)

Complete the following sentences:

1. Smart clothes can **light up** in the dark and keep themselves **clean**.
2. Steel is made of a mixture of **iron** and other elements, while concrete is made of a mixture of rock, **sand** and **water**.
3. Concrete is in **liquid** state when it is formed, while after it dries, it becomes in **solid** state.
4. Concrete is used as the base of **buildings** and **bridges** as it is very strong.
5. Plastic is made by **chemical** change of some compounds of **petroleum**.
6. Glass is a mixture of **sand** , **limestone** and sodium carbonate.
7. Petroleum is a liquid material, while plastic is **tough solid** material.
8. Chemical change of some compounds of petroleum is used in making **plastic**.

Give reasons for:

- Smart clothes have many benefits.
  - **Because smart clothes:**
    - **Control your body temperature.**
    - **Light up in the dark.**
    - **Keep themselves clean.**

- Properties of plastic are different from properties of petroleum.

- **Because when chemical change happens, the properties of the new material (plastic) differ from the properties of the original material (petroleum).**

- Scientists should study the structure of molecules of different materials.
  - **To understand their chemical structures that help in understanding their properties.**

What happens if...:

- You are wearing smart clothes in a dark place.
  - **They will light up.**

- Mixing rock, sand and water together.
  - **Concrete will form.**

- Making chemical change to some compounds of petroleum.
  - **Plastic will form.**

- Mixing sand, limestone and soda ash at high temperature.
  - **Glass will form.**

- Concrete is left to dry.
  - **It becomes hard.**

Look at the opposite picture, then put (√) or (x):



- Concrete is made of water and plastic. (**X**)
- Concrete stays in the liquid state after it dries. (**X**)
- Concrete is created by adding high temperature to plastic. (**X**)
- Concrete is considered a flexible fabric. (**X**)